Form P6567
Edition 12
July 2008
CCN: 03531480

Starters

Series SS815, SS825 and SS850

Installation and Maintenance Information

EN Installation and Maintenance Information
ZH 安装和维护信息
JA 据付および保守の情報

Product Safety Information

Intended Use:

These air starters are intended for use in starting reciprocating internal combustion engines. These starters are designed to be operated from a remote location after proper installation on the engine requiring starting.

For additional information refer to Air Starters for Internal Combustion Engines Product Safety Information Manual Form 45558624. Manuals can be downloaded from www.irtools.com.

Placing Starter in Service

NOTICE

For natural gas operation, starter main exhaust must be piped away.

To pipe the drive housing vent, remove the drive housing plug and replace it with a suitable tubing line. The tubing must vent at a safe location and must not be interconnected with any other exhaust lines which might introduce a back pressure on the drive housing vent.

Lubrication

Proper lubrication is essential for top performance and maximum durability of a Starter.

Two lubrication systems are recommended:

Ingersoll Rand No. HDL2 Lubricator: For Starter installations with cranking cycles of less than 10 seconds. Install as shown in Dwg. TPB978. (See **Installation of HDL2 Lubricator** on EN-4). Lubricate with diesel fuel or 10W non-detergent motor oil.

Ingersoll Rand No. NL-24-8 In-Line Lubricator:
For Starter installations with cranking cycles more than 10 seconds. Install as shown in Piping Diagrams. Lubricate with a good quality 10W non-detergent motor oil. Adjust the Lubricator to flow 1 to 3 drops per second.

CAUTION

When an HDL2 Lubricator is used, make certain that the oil supply line pressure is no greater than 5 psi. If there is pressure on the line, the Lubricator will continuously leak lubricant through the Starter and out of the exhaust.

Installation

NOTICE

For maximum performance, read this manual prior to the installation or operation of Series SS815, SS825 and SS850 Starters.

General Information

1. We recommend that on all vehicular installations and on stationary engines subject to vibration that hoses of the specified diameter be used instead of rigid pipe connections to the starter. Vehicle and engine vibration will soon loosen rigid pipe connections, whereas hoses will absorb the vibration and connections will remain tight.
2. This starter is designed for flange mounting at the inlet. All piping, hoses and fittings must be clean and free of dirt and foreign material during installation.
3. In the actual mounting of an Air Starter, it is best to have the hose connections already made at the receiver, and to have the starter end of the hose handy for attaching to the Starter.
4. Engine design often demands that the starter be mounted underneath in extremely close quarters, and even though two of the mounting bolt holes are easy to reach, the third one is often less accessible. To install a starter, the following tools are required: a regular ratchet wrench, sockets, universal joint, socket extension and a single or double-end box wrench.
5. The efficiency of an Air Starter can be greatly impaired by an improper hook-up. Hoses smaller than those recommended will reduce the volume of air to the motor and the use of reducers for piped-away applications in the exhaust port will restrict the exhaust causing back pressure to the motor resulting in reduced performance. The number of tees and elbows, and the length of the supply line should be kept to a minimum. Use 1-1/2" #24 hose or pipe for supply lines upto 15 feet long; use 2" hose or pipe if the supply line is over 15 feet long.
6. A leak in any of the connections in live air lines means that the system will drain overnight and will have to be re-pressurized the next morning by use of another vehicle or compressor. Make your connections bubble tight to avoid unnecessary costs and delays. On all threaded connections throughout the system, use **Ingersoll Rand** No. SMB-441 Sealant, non-hardening No. 2 Permatex or Loctite®* Pipe Sealant. Always run your air supply line from the side or top of the receiver, never at or near the bottom. Moisture in the air collects at the bottom of the receiver resulting in damage which could cause the valves to become inoperative. Periodically, open the petcock at the bottom of the tank to drain the water.

* Registered trademark of Loctite Corporation.

Orientation of the Air Starter

If the factory orientation will not fit your engine due to radial location of the Drive Housing or location of the inlet and/or exhaust ports, reorient the Starter as follows:

1. Look at the dimension illustration and note that the Drive Housing (30) can be located in any one of sixteen radial positions relative to the Gear Case (58). The exhaust port (Motor Housing) (1) can be located in any one of four radial positions relative to the Gear Case and the air inlet (Motor Housing Cover) can be located in any one of four radial positions relative to the exhaust port. Also, the Drive Housing can be installed on the engine bell housing in any one of three radial positions.

NOTICE

Do not separate the Drive Housing from the Gear Case during orientation or installation.

2. Study the engine mounting requirements and determine the required orientation of the Drive Housing relative to the Gear Case. If the Drive Housing has to be reoriented, remove the eight Drive Housing Cap Screws (28) and rotate the drive housing to its required position. Reinstall the Drive Housing Cap Screws and tighten them to 28 ft-lb (38 Nm) of torque.

NOTICE

Do not separate the Motor Housing from the Motor Housing Cover during orientation or installation.

3. Now that you have the Drive Housing properly oriented relative to the Gear Case, notice whether or not the exhaust port will be at the bottom and whether or not the inlet port will be favorably located for hose installation. If either or both of these members must be reoriented, remove the four Motor Housing Cover Cap Screws (4) and rotate the Motor Housing and/or Motor Housing Cover to its desired position. Reinstall the Motor Housing Cover Cap Screws and alternately tighten them to 60 ft-lb (81.4 Nm) of torque.

Mounting the Air Starter

1. Study the Piping Diagram. We strongly recommend that the Starter be connected exactly as shown.
2. The air receiver tank for a Starter installation must have a working pressure capability equal to or greater than the maximum pressure at which the Starter will be operated.

WARNING

Bleed off the air pressure through a valve or petcock. Do not remove the plug from the tank while the tank is still pressurized.

3. If you are going to connect to a receiver tank that is already in service, bleed off the air pressure by opening the drain valve. Drain off any water that may have accumulated in the bottom of the tank.

NOTICE

Make certain the connection between the SRV150 Starter Relay Valve and the Receiver Tank is made to the inlet side of the Relay Valve indicated by the word "IN" cast on the valve body.

4. Using a 1-1/2" short nipple, install the SRV150 Starter Relay Valve on the end of the receiver tank as shown in Dwg. TPC444-4 on EN-7.
5. Install the No. SMB-618 Starter Control Valve on the dash panel (for vehicular installations) or some other appropriate panel (for stationary installations).
6. Attach No. TA-STR-100 Starter Instruction Label to the control panel adjacent to the Starter Control Valve.
7. Mount the No. 150BMP-1064 Air Pressure Gauge on or adjacent to the control panel. It should be located where it is readily visible to the operator of the Control Valve.

NOTICE

When connecting the Starter Control Valve to the Relay Valve, make certain the hose is connected to the "SUMP" side of the Starter Control Valve.

8. Connect the Starter Control Valve to the Relay Valve with 1/4" #4 hose. Install a Tee in this line with a short feeder hose to the Pressure Gauge.
9. Run a piece of heavy duty garden hose, or some other similar large diameter hose from the Relay Valve on the receiver to the starter location on the engine to determine the exact length of 1-1/2" #24 air hose required.
10. Attach the 1-1/2" #24 air hose to the outlet side of the Relay Valve, and run the hose through the frame, etc. to its final position at the starter location.
11. At this point, determine whether or not it is practical to attach the hose to the Starter before or after the Starter is actually mounted. In many cases, it may be necessary to attach the hose to the Starter before mounting.
12. Liberally grease the teeth on the ring gear with a good, sticky gear grease or motorcycle chain lubricant. This will help promote the life of the ring gear and the Starter Pinion.
13. Place the Starter into position and mount it on the flywheel bell housing. Tighten the mounting bolts to 100 ft-lb (136 Nm) of torque.
14. Install a 1/4" #4 hose line from the "DEL" side of the Starter Control Valve to the "IN" port on the Starter Drive Housing.
15. Install a 1/4" #4 hose line from the "OUT" port on the Starter Drive Housing to the small pipe tapped port on top of the Starter Relay Valve.
16. If the exhaust is not to be piped away, install a No. SS660-A674 Muffler or No. SM450-A735 Road Splash Deflector in the exhaust port on the Motor Housing of the Starter.
17. If the engine on which the Starter is mounted does not have a bell housing with a standard starter mounting, and a bracket had to be manufactured for mounting, we recommend that you add an additional support bracket at the motor end of the Starter. There are four holes in the Motor Housing Cover for this purpose. They are tapped M10-1.50 to accommodate metric cap screws.
18. Mount an HDL2 Lubricator on or near the Starter as shown in Dwg. TPB978 on EN-4.
19. Pressurize the complete starting system and check every connection with a soap bubble test. There must be no leaks.

Barring Over the Engine

Occasionally, for setting injectors and/or for timing purposes, it may be desirable to bar over the engine in such a manner that any given piston can be stopped at any given location. This is very easily done with a SS815, SS825 or SS850 Starter.

1. Disconnect the 1/4" #4 hose at the "**OUT**" port on the Drive Housing, and plug the hole in the Drive Housing with a 1/4" pipe plug.
2. Remove the 3/8" pipe plug from the center of the Motor Housing Cover.
3. Engage the Drive Pinion with the flywheel by applying pressure to the "**IN**" port on the Drive Housing.
4. Insert a 3/8" square drive wrench through the hole in the Motor Housing Cover to engage the square drive recess the rear of the Rotor.
5. Manually rotate the Rotor until the engine is cranked to its desired position.

The HDL2 Lubricator is self-priming and may be installed directly on the Starter or located remotely. Although the Lubricator is capable of drawing lubricant from a source 4 ft (1.2 m) lower than the point of installation, **Ingersoll Rand** recommends installing the Lubricator as close as possible to the oil source. We recommend using the unpressurized fuel return line as the source of lubricant. However, oil may be supplied from a separate receiver or the diesel fuel tank. When the diesel fuel tank is the lubricant source, install a 10 micron to 50 micron fuel filter in the oil supply line at the fuel tank. The lubricant supply line should be fed into the fuel return line with the leg of the tee going to the lubricator directed in the down direction to insure that the lubricator does not draw air instead of oil.

INSTALLATION OF HDL2 LUBRICATOR

REMOTE INSTALLATION OF HDL2 LUBRICATOR

(Dwg. TPB978)

Mount the HDL2 Lubricator as follows:

1. If you are going to mount the HDL2 Lubricator on the Starter, remove one of the 3/8" pipe plugs from the inlet boss on the Starter and replace it with the HDL2. If you are going to mount the HDL2 at a remote location, use two U-bolts and base clamp available for the Lubricator.
2. If you mounted the HDL2 at a remote location, install a 1/4" #4 hose from the end of the Lubricator having both a male and female thread to one of the 3/8" pipe tapped holes on the Starter inlet boss.
3. Install a 1/4" hose from the 1/8" NPTF oil inlet in the side of the HDL2 to the unpressurized fuel line, diesel fuel tank or separate oil reservoir. Tighten the fitting at the Lubricator to 15 to 36 ft-lb (20.3 to 40.8 Nm) torque. The threads on the fitting must be clean; assemble it without sealing compound or Teflon®* tape. Connection must be vacuum tight.

NOTICE

Before initial operation, manually fill the oil supply line.

4. If a separate lubrication reservoir is used, fill it with diesel fuel or a light motor oil such as SAE 10 or 10W.

Mounting Dimensions for Series SS815 and SS825 Starters

(Dwg. TPA1325-1)

Mounting Dimensions for Series SS850 Starters

Ø
Inlet
Exhaust
45°
90° Typ.
Control Ports
R 64.3 (2.5)
Ø 17.5 (.68) Typ. 3- Places
Left Hand Rotation
Right Hand Rotation
RING GEAR FACE
23.34 (.9)
152.3 (6.0)
Pilot
180.0 (7.1)
1/4-18 NPT Control Port Outlet
10.7 (.4)
Drive Housing
20.0 (.8)
18.0 (.7)
186.5 (7.3)
28.5 (1.1)
361.5 (14.2)
168.0 (6.6)
Ø 110.2 (4.3)
1/4-18 Npt Control Port Inlet
263.0 (10.4)
48.2 (1.9)
Gear Case
2 1/2-8 NPT
Exhaust
375.0 (14.8)
1 1/2 - 11 1/2 NPT
Lubricator Connection both Sides.
Motor Housing
Inlet
Cover
53.2 (2.1)
108.0 (4.3)
65.2 (2.6)
Remove Pipe Plug for Access to 3/8 Sq. Drive Barring Hole in Rotor.
R 43.6 (1.7)
R 48.7 (1.9)
M10-1.5 Th'd 16.0 (.63) Deep 2-places (For Rear Support)
Ø 172.0

Notes:

1. Starters Should be Installed on the Engine with the Exhaust Pointed Down.
2. Use the Set of Control Ports on the Upper Side of the Drive Housing.
3. These Models are not Approved for Applications where the Starter is Exposed to the Transmission Fluid.
4. Drive Housing Orientation Code is Based on Position of Mounting Hole Opposite the Control Ports.
5. Standard Orientation Shown (02E) will be Shipped Unless Otherwise Specified.
6. Please Read the Instructions Before Attempting to Reorient.
7. Starter Weight = 25.4 Kg (56 Lbs.)

Dual Dimensions: mm (Inch)

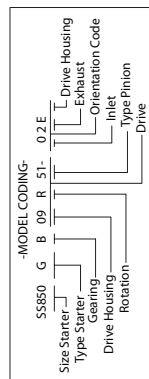
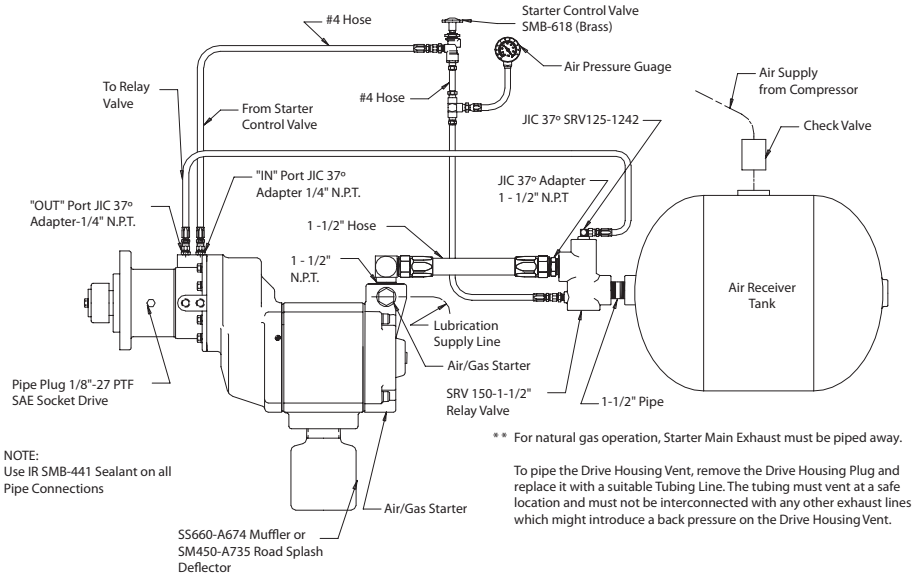
Orientation Options

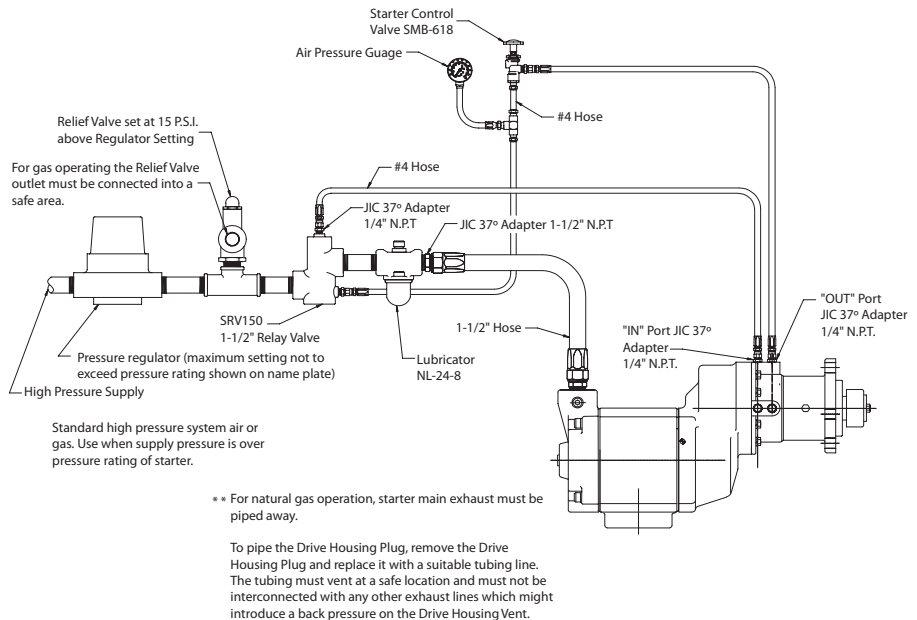
Inlet	Exhaust	Drive Housing
4 @ 90°	4 @ 90°	16 @ 22 1/2°

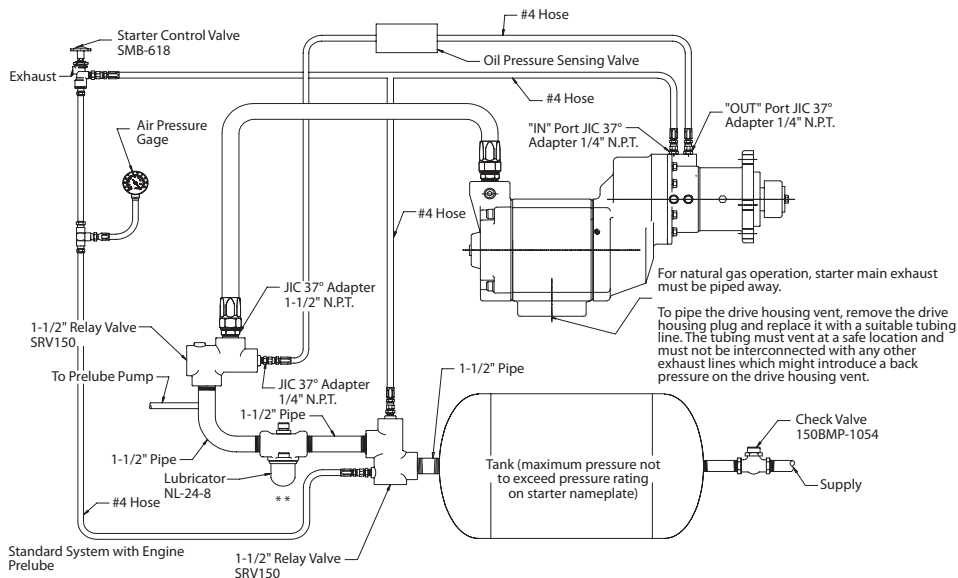
-MODEL CODING-

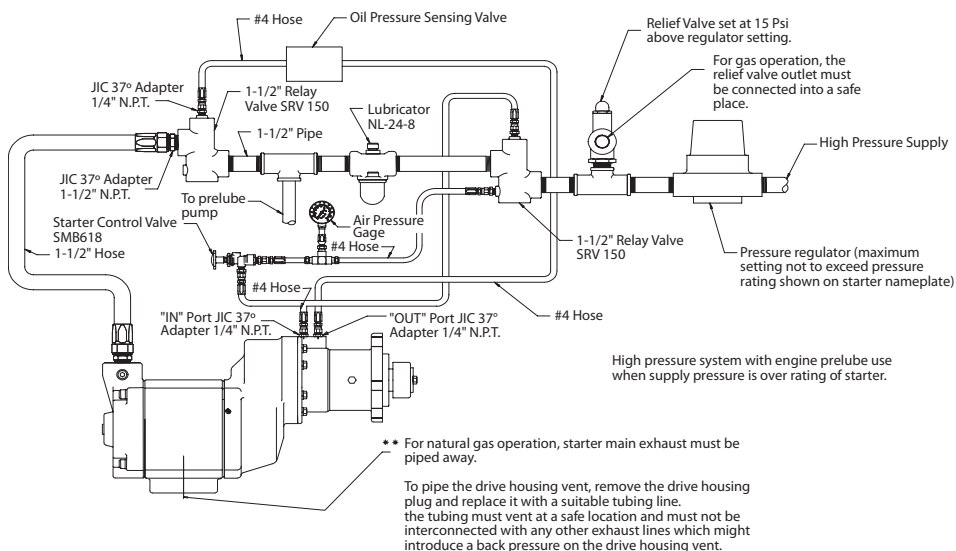
SS850 G B 09 R 51- 02 E

- Size Starter
- Type Starter
- Gearing
- Drive Housing
- Rotation
- Drive
- Type Pinion
- Inlet
- Orientation Code
- Exhaust
- Drive Housing

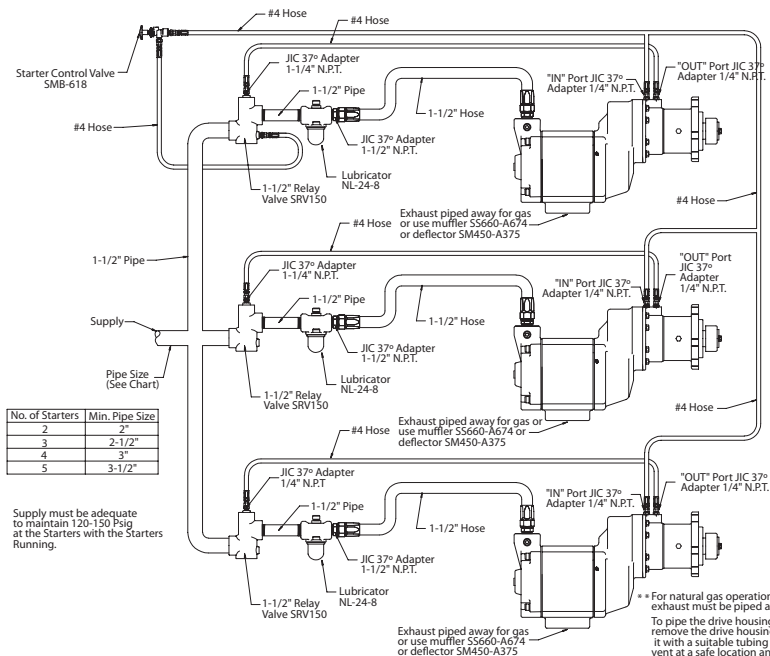
(Dwg. TPA832-5)

Typical Vehicular Installation (Shown with SS815 Starter)

(Dwg. TPC444-4)

Typical Stationary Installation (Shown with SS815 Starter)

(Dwg. TPA842-2)

Typical Installation with Engine Prelube System

(Dwg. TPA843-2)

Typical Installation with Engine Prelube System when Supply Pressure is over Rated Starter Pressure

(Dwg. TPA844-2)

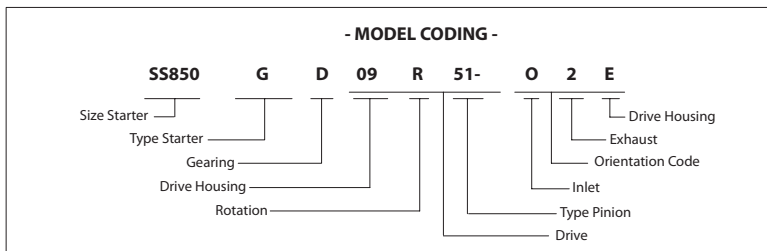
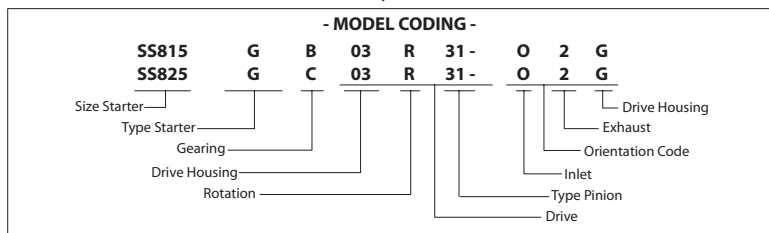
Typical Multiple Starter Installation

No. of Starters	Min. Pipe Size
2	2"
3	2-1/2"
4	3"
5	3-1/2"

(Dwg. TPA847-2)

How to Order a Starter

MODEL CODING FOR SS815, SS825 AND SS850 STARTERS

(Dwg. TPD1495)

ZH

产品安全信息

用途：

此类空气启动器应用于往复式内燃机的启动。此类启动器应在正确安装到需要启动的内燃机上后，进行远程操作。

更多信息请参见内燃机空气启动器产品安全信息手册表 45558624。
手册可从 www.irtools.com 下载。

使启动器处于使用状态

注　意

对于天然气操作，必须用管道排出起动器的主排气管。

要用管道连接传动箱处排气口，先卸下传动箱阀塞，然后用适当的管线替代。管线必须在安全的位置排气，并且不得与任何其他排气管线互连，这些管线可能会对传动箱阀产生回压。

润滑

正确润滑对达到起动器的最高性能和最大耐用性非常重要。

建议的两种润滑系统：

Ingersoll Rand No.HDL2 润滑器： 要安装盘车时间期低于 10 秒的起动器。请按图 TPB978 进行安装。（请参见 EN-4 上 HDL2 滑润器的安装方式）。使用柴油或 10W 非中性清洁剂机油。

Ingersoll Rand No. NL-24-8 轴向滑润剂：
要安装盘车时间高于 10 秒的起动器。请按管道布置图进行安装。使用优质的 10W 非中性清洁剂机油来润滑。调整润滑器以使其每秒涌出 1 至 3 滴。

小　心

在使用 HDL2 润滑器时，请确保油供应管线压力不高于 5 psi。

如果管线上有压力，则润滑剂将通过起动器和排气装置外部继续渗漏。

安装

注　意

要获得最大性能，请在安装或操作系列 SS815、SS825 和 SS850 起动器之前阅读本手册。

一般信息

1. 我们建议在受到振动的所有车载装置和固定发动机上，应该使用指定的软管而非刚性管来连接至起动器。车辆和发动机振动会很快松动刚性管连结，而软管会缓冲此振动，从而使连结保持紧固。
2. 该起动器供在进口处的法兰装置之用。在安装时，所有管道、软管和装设阀门都必须清洁、无灰尘和异物。
3. 在实际安装气动起动器的过程中，最好已在接收器中连接软管，并使软管的起动器末端便于连接到起动器。
4. 通常，发动机设计要求起动器应安装在向下近四分之一处，而且虽然其中两个装配螺栓孔易于触及，但是第三个孔却常常难以触到。要安装起动器，需要以下工具： 常用的棘轮扳手、套筒、万向接头、伸缩套筒和单头或双头套筒扳手。
5. 连结不当会大大削减气动起动器的效率。使用小于所建议尺寸的软管会使进入马 达内部的空气量减 少，而且使用在排气管端口内的排放装置（即渐缩管）将会限制排气（对导致性能降低的发动机造成反压力）。三通和弯头的数量以及供应管线的长度都应最小化。如果供应管线长达 15 英尺，可使用 1-1/2″ #24 软管或管道；如果供应管线超过 15 英尺，可使用 2”软管或管道。
6. 活动空气管道中的任何连接装置出现泄漏状况都表明，系统将会整夜排放并必须在第二天早上通过使用另一台车辆或压缩机来增压。使连接气泡紧密以避免不必要的费用和延迟。在整个系统的所有螺纹连接装置上，使用 **Ingersoll Rand** No. SMB-441 Sealant、非硬化的 No. 2 Permatex 或 Loctite®* Pipe Sealant. 务必从接收器的侧面或顶部运行空气供应管线，切勿在底部或底部附近运行。空气中的水分聚集在接收器的底部，便可能导致阀门损坏以致无法使用。定时打开箱底部的小龙头以排出水份。

*Loctite Corporation 的注册商标。

气动起动器的定向
如果工厂定向因传动箱的径向位置或进气口和/或排气管端口而无法安装发动机，请按如下方式重新定向起动机：

1. 请参见尺寸图示，另请注意，传动箱 (30) 可位于与齿轮箱 (58) 相对的 16 个径向位置中的任一处。排气管端口（电动机外壳）(1) 可位于与齿轮箱相对的 4 个径向位置中的任一处，并且空气进口阀（马外壳盖）可位于与排气管端口相对的 4 个径向位置中的任一处。另外，可将传动箱安装在位于 3 个径向位置中任一处的发动机外箱上。

注　意

切勿在定向或安装时分开传动箱和齿轮箱。

2. 学习发动机安装要求，并确定与齿轮箱相对的传动箱的所需定向。如果传动箱必须重新定位，可卸下 8 个传动箱有头螺丝 (28)，然后将传动箱旋转至所需位置。重新安装传动箱有头螺丝，并将其旋紧至 28 英尺-磅（38 牛米）扭矩。

注　意

切勿在定向或安装时分开马外壳和马外壳盖。

3. 既然已正确定位与齿轮箱相对的传动箱，请注意排气管端口是否位于底部，以及进气口是否处于有利于软管安装的位置。如果以上任何一个或两个装置都必须重新定向，可卸下 4 个电动机外壳盖有头螺丝 (4)，然后将电动机外壳和 / 或电动机外壳盖旋转至所需位置。重新安装电动机外壳盖有头螺丝，并交替地将其旋紧至 60 英尺-磅（81.4 牛米）扭矩。

安装气动起动器

1. 学习管道布置图。我们强烈建议按如图所示的方式准确连接起动器。
2. 起动器装置的空气接收箱必须具有工作压力性能（等于或大于起动器将会操作的最大压力）。

警　告

通过阀或旋塞排出气压。当气罐仍处于增压状态时，切勿从箱上拔下塞子。

3. 如果要连接到正在工作的接收箱，可通过打开排水阀排出气压。排出积聚在罐底部的水份。

注 意

确保已将 SRV150 起动器主 启动阀和气罐连接到继动阀进口侧 (在阀座上标注为字母“IN”)。

4. 使用 1-1/2” 的短螺纹接套将 SRV150 起动器主 启动阀安装在气罐末端，如图 TPC444-4（EN-6 上）所示。
5. 请在仪表板上（车载装置）或某些其他相应面板上（固定装置）安装 No. SMB-618 起动器控制阀。
6. 将 No. TA-STR-100 起动器说明标签贴在邻近起动器阀的控制面板上。
7. 将 No. 150BMP-1064 压力表安装在控制面板上或邻近控制面板处。它应位于控制阀操作者容易看到的地方。

注 意

当将起动器控制阀连接到主 动阀时，确保已将软管连接到起动器控制阀的“SUMP”侧。

8. 将起动器控制阀连接到具有 1/4”#4 软管的继动阀上。使用短进料软管将此管道中的 T 形管安装到压力计上。
9. 要确定所需的 1-1/2” #24 进气软管的确切长度，可运行大功率橡胶软管或某些其他相似的大直径软管（从接收器的主启动阀到发动机的起动器位置）。
10. 将 1-1/2” #24 进气软管连接到主启动阀的出口侧，并使软管从机架等穿过起动器处的最终位置。
11. 在此，可在实际安装起动器前后，确定是否可将软管连接到起动器。在多数情况下，可能需要在安装之前将软管连接到起动器。
12. 请使用优质粘性齿轮润滑油或摩托车链条润滑剂，充分润滑环形齿轮上的齿轮。这将有助于延长环形齿轮和起动器小齿轮的寿命。
13. 将起动器各就其位，然后将其安装在飞轮外壳上。旋紧安装螺栓至 100 英寸-磅（136 牛米）扭矩。
14. 请在起动器控制阀的“DEL”侧和起动器传动箱上的“IN”端口之间安装 1/4” #4 软管管线。
15. 在起动器传动箱的“OUT”端口和起动器继动阀顶端的小管道分接部分之间安装 1/4” #4 软管管线。
16. 如果排气装置无法排气，可在起动器的马达外壳的排气管端口中安装 No. SS660-A674 消声器或 No. SM450-A735 公路防溅导向板。
17. 如果装有起动器的发动机没有外壳（配有标准起动器装置），以及为该装置制造的托架，我们建议您在起动器的电动机尾部增加其他支架。为此，马达外壳盖中有 4 个孔。它们是分接的 M10-1.50 以符合米制有头螺丝。
18. 将 HDL2 润滑器安装在起动器上或起动器附近，如图 TPB978（在 EN-3 上）所示。
19. 加压整个起动系统，并使用皂气泡测试检查各个连接。确保不会出现渗漏状况。

停止发动机

有时，为了设置喷射器和/或定时，可能需要以此方式（所提供的活塞可在任何给定地点停止）停止发动机。这可通过 SS815, SS825 或 SS850 起动器轻易完成。

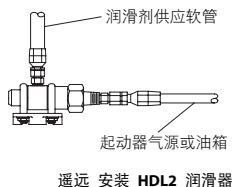
1. 在传动箱的“**OUT**”端口拔下 1/4” #4 软管，并使用 1/4” 管道塞子堵住传动箱中的孔。
2. 从电动机外壳盖中央取下 3/8” 管道塞子。
3. 通过将气压应用于传动箱的“**IN**”端口，可使用飞轮安装传动小齿轮。
4. 通过外壳废气盖中的孔插入 3/8” 四方传动扳手，以将四方传动凹槽安装到转子尾部。
5. 手动旋转转子直至发动机弯曲到所需位置。

HDL2 润滑器可自动充满，并可直接安装在起动器上或位于远处。虽然润滑器能从较安装点低 4 英尺（1.2 米）的油源处吸油，但 **Ingersoll Rand** 建议将润滑器安装在距油源最近的地方。我们建议使用非增压回油管线作为润滑剂的来源。但是，也可从单独接收器或柴油箱供油。当柴油箱是润滑油来源时，可在燃油箱的油供应管线中安装一个 10 微米至 50 微米的燃油过滤器。润滑剂供应管线应装入具有 T 形管支管（向下流入润滑器）的回油管线，以确保润滑器无法吸气而不是油。

安装 HDL2 润滑器

遥远 安装 HDL2 润滑器

(图. TPB978)

按以下方式安装 HDL2 润滑器：

1. 如果要在起动器上安装 HDL2 润滑器，可从起动器的进口主管中取下 3/8” 管道塞子，然后将其更换为 HDL2。如果要在远处安装 HDL2，可使用润滑器可用的两个 U 形螺栓和压板。
2. 如果在远处安装了 HDL2，便可在具有外螺纹和内螺纹的滑润器末端和起动器进口主管的3/8” 管道分接孔之间安装 1/4” #4 软管。
3. 请在 HDL2 侧的 1/8” NPTF 油进口和非增压燃油管线、柴油箱或单独油箱之间安装 1/4” 软管。将润滑器的装置旋紧至 15 至 36 英寸-磅（20.3 至 40.8 纳米）扭矩。装置的螺纹必须清洁；不可使用密封剂或 Teflon®* 胶带安装。必须保证连接的真空严密性。

注 意

在首次操作之前，可手动将油注入供油管线中。

4. 如果使用单独润剂储存罐，可向其中注入柴油或轻质机油（如 SAE 10 或 10W)。

SS815 和 SS825 系列起动器的安装尺寸

(图. TPA1325-1)

SS850 系列起动器的安装尺寸

定向选项		
入口	排气装置	传动箱
4 @ 90°	4 @ 90°	16 @ 22 1/2°

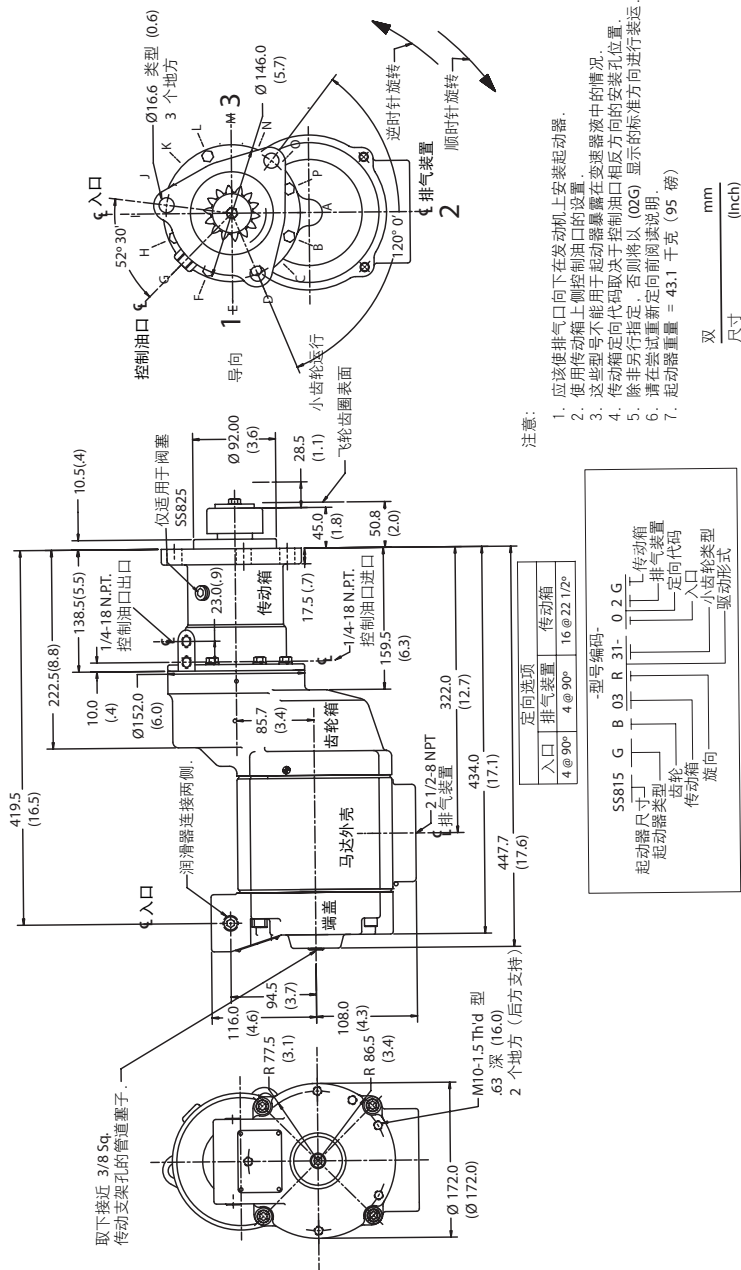
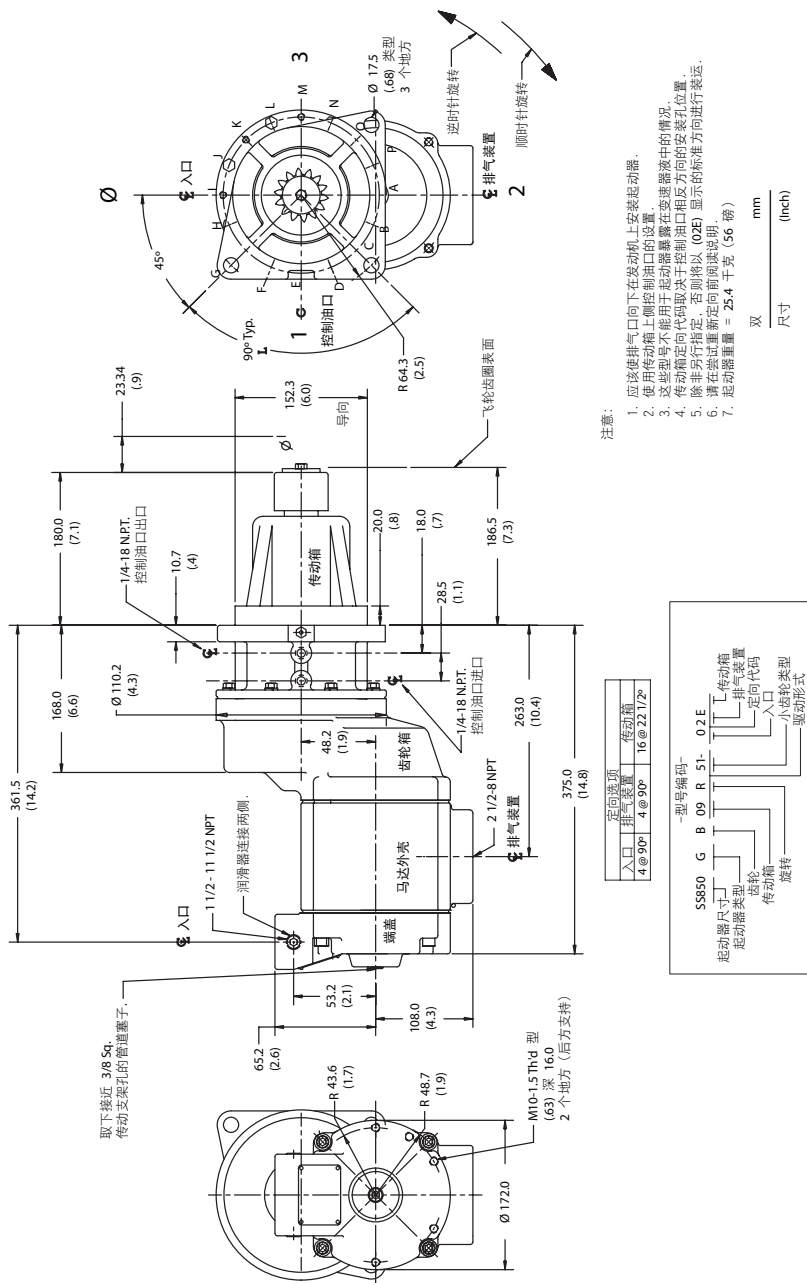
-型号编码-

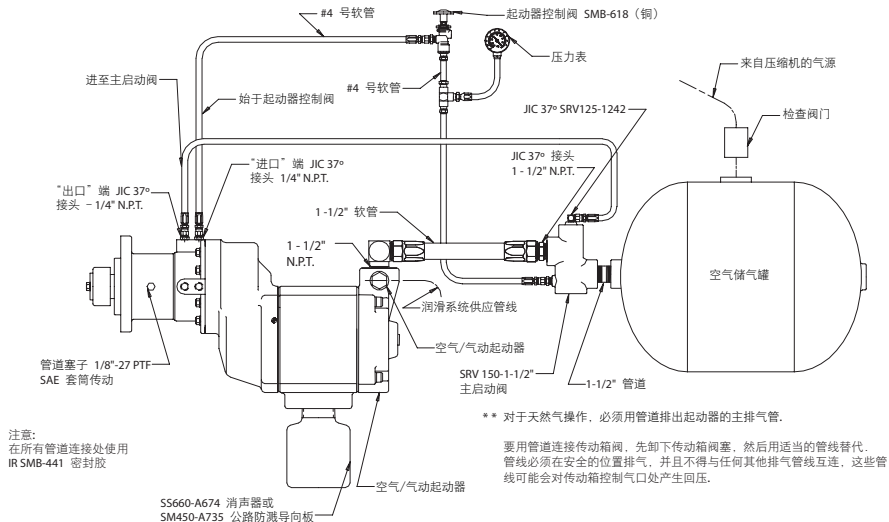
SS850 G B 09 R 51- 0 2 E

- 起动器尺寸
- 起动器类型
- 齿轮
- 传动箱
- 旋转
- 驱动形式
- 小齿轮类型
- 入口
- 定向代码
- 排气装置
- 传动箱

注意：

1. 应该使排气口向下在发动机上安装起动器.
2. 使用传动箱上侧控制油口的设置.
3. 这些型号不能用于起动器暴露在变速器液中的情况.
4. 传动箱定向代码取决于控制油口相反方向的安装孔位置.
5. 除非另行指定，否则将以 (02E) 显示的标准方向进行装运.
6. 请在尝试重新定向前阅读说明.
7. 起动器重量 = 25.4 千克（56 磅）

双	mm
尺寸	(Inch)

(图. TPA832-5)

典型的车载安装（通过 **SS815** 起动器显示）

(图. TPC444-4)

典型的固定安装（通过 **SS815** 起动器显示）

(图. TPA842-2)

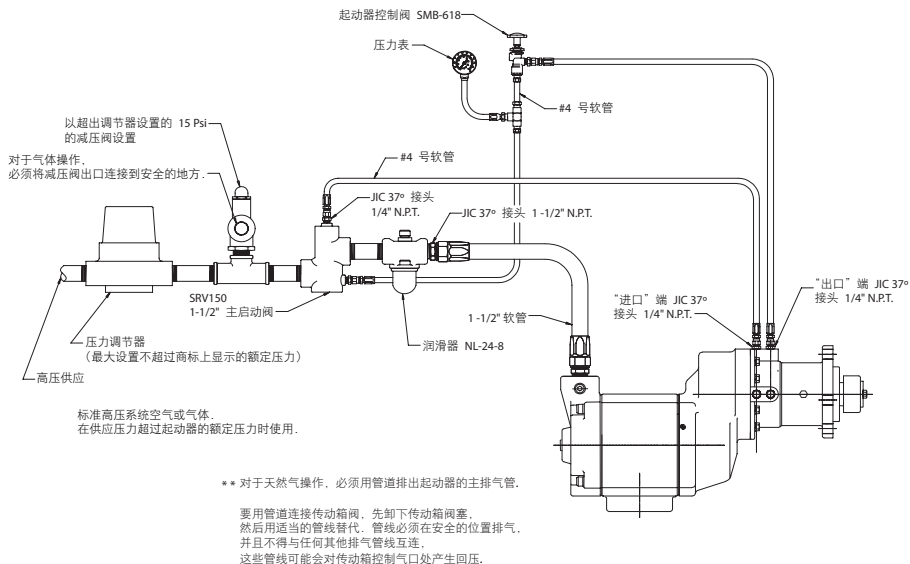
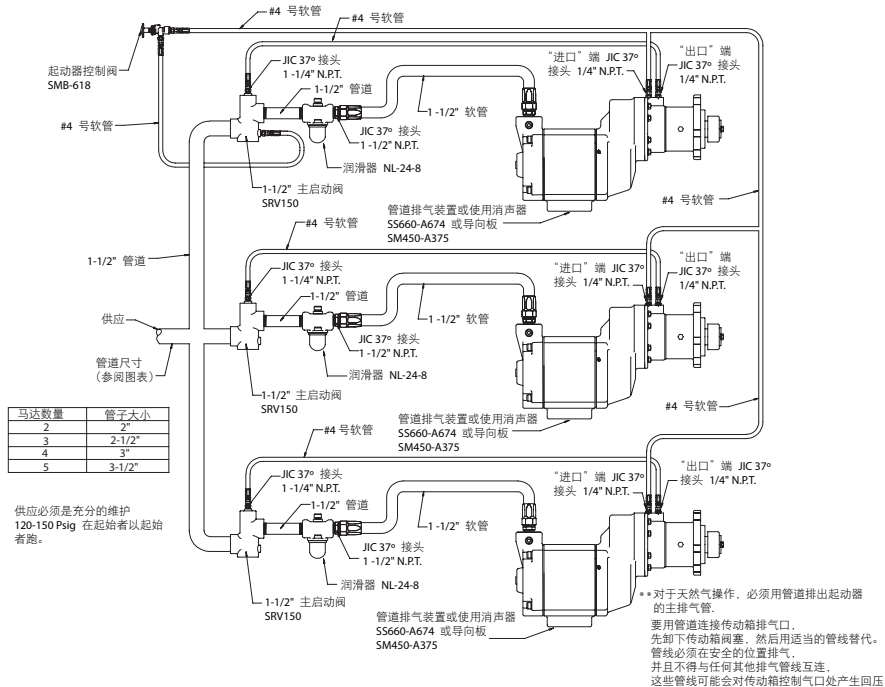
具有发动机预先润滑系统的典型安装

(图. TPA843-2)

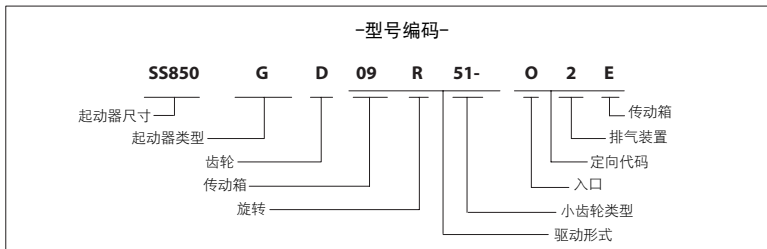
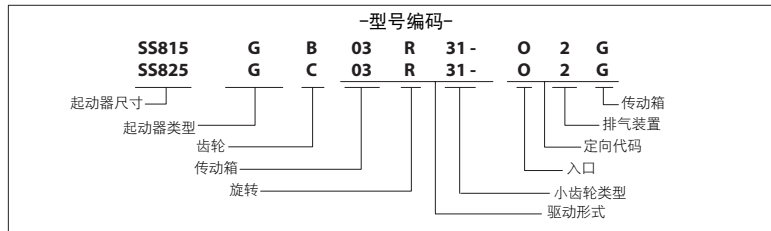
具有发动机预先润滑系统的典型安装时供应压力超过起动器压力的额定值。

(图. TPA844-2)

典型多起动器安装

马达数量	管子大小
2	2"
3	2-1/2"
4	3"
5	3-1/2"

(图. TPA847-2)

如何订购起动器

SS815，SS825 和 SS850 代码编号含义

(图. TPD1495)

製品に関する安全性

製品に関する安全性

これらのエアスターターは、往復内燃機関の始動に使用することを目的としています。これらのエアスターターは、始動させる必要のある往復内燃機関に正しく取り付けた後、離れた場所から操作するように設計されています。

詳細は、「内燃機関用エアスターター製品安全情報説明書 45558624」を参照してください。
www.irools.com から説明書をダウンロードすることができます。

始動装置の供用

備考

天然ガス運転をする場合、始動装置のメイン排気は、配管で排出する必要があります。

駆動部筐体排出口に配管するために、駆動部筐体栓を外して適切な管類ラインに取り換えます。管類は、安全な位置で排気する必要があり、駆動部筐体の排出口に逆圧の発生を招くおそれのある他の排気ラインとの相互接続をしないようにする必要があります。

潤滑

適切な lubrication は、始動装置の、最高の性能および最大の耐久性を得るのに必須です。

2 種類の lubrication システムを推奨します。

Ingersoll RandNo. HDL2 ルブリケータ。クランキング サイクルが10秒以下の始動装置の再組付けの場合。図面 TPB978.に示されているように再組付けします。(EN-4 **に記載されている HDL2 ルブリケータの再組付けを参照してください**)。. ディーゼル燃料または 10W 非洗浄性モーター オイルで潤滑します。

Ingersoll Rand No. NL-24-8 インライン ルブリケータ。
クランキング サイクルが10秒より長い始動装置の再組付けの場合。配管図に示されるように再組付けします。良質の 10W 非洗浄性モーター オイルで潤滑します。ルブリケータを1秒間に1~3滴流れるように調整します。

注意

HDL2 ルブリケータをご使用になるときは、すべての給油ラインの圧力が 5 psi を超えていないことを確認します。ラインに圧力が掛かっている場合、ルブリケータは、常に、始動装置を通って排気管の外に潤滑剤を漏出します。

再組付け

備考

最高の性能を得るために、シリーズ S815,SS825 および SS850 始動装置の再組付けまたは運転の前にこの取扱説明書を熟読してください。

一般情報

1. すべての車両への再組付けおよび振動に晒される固定エンジンについて、始動装置に配管による固定した接続を行うのでなく、規定の口径のホースをご使用になることを推奨します。車両およびエンジンの振動により固定した配管接続は直ぐ緩みますが、ホースの場合、振動を吸収し、接続は強固なままです。
2. この始動装置は、吸気口でフランジに取り付けられるように設計されています。すべての配管ホースおよび取付金具は、再組付け中に、清浄で、ほこりおよび異物がないようにする必要があります。
3. 空気始動装置を実際に取り付ける場合は、ホースは前以て受け器側での接続を済ませ、始動装置側の端は、始動装置に取り付けられるように近くに置いておくのが最も適切です。
4. エンジンの設計により、始動装置が非常に近接した部屋の下に取り付けられ、2つの取り付けボルト用穴は、容易に手が届くにも拘らず、3つ目に穴が、しばしば手が届きにくいということが頻繁に要求されます。始動装置を再組付けするには以下の工具が必要です。レギュラー ラチェット レンチ、ソケット、自在継手、ソケット伸長器および片口または両口のボックス レンチ
5. [空気始動装置] の効率は、不適切な接続によって非常に損なわれることがあります。推奨したホースより小さいホースは、モーターへ送る空気量を減少させ、排気ポート内の、配管による排出用の抑制器を使用すると、排気を制限し、これによりモーターに逆圧を生じさせ、結果的に性能を低下をもたらします。T字型分岐および肘継手の数量および供給ライン長さは最小限に抑えてください。15 フィート長までの供給ラインには1-1/2" インチ#24 のホースまたはパイプを使用し、15 フィート長を超える場合は、供給ラインには 2 インチのホースまたはパイプを使用します。
6. 使用中の送気管のどこかの接続部に漏れがあるということは、システムが一晩中空気を流出しているということであり、翌朝、別の車両またはコンプレッサを使用して元通りに圧力を上げる必要があります。接続部から気泡が漏れないように締め付け、不要なコストや遅れの発生を避けます。システム全体のすべてのネジ接続は、**Ingersoll Rand** No. SMB-441 シーリング材、非硬化剤 No. 2 Permatex または Loctite®* パイプ シーリング材を使用します。常に、ご使用の給気ラインを受け器の側面または最上部から敷くようにし、決して底部またはその付近から敷くことのないようにします。空気中の湿気は、受け器の底に集まり、バルブの動作不能を引き起こすおそれのある損傷をもたらします。定期的に、タンクの底部のコックを開放して排水します。

空気始動装置の方向

工場で設定された方向が、[駆動部筐体] の放射状配置または吸気/排気ポートの配置のためにご使用のエンジンに合わない場合、以下のようにして [始動装置] の方向を変えてください。

1. 寸法入りの説明図をご覧になり、[駆動筐体] (30) が [変速装置] (58) に対して16箇所の放射状位置のどの位置にも配置できることにご注意ください。
   排気ポート ([モーター筐体]) (1) は [変速装置] に対し、4 箇所の放射状位置のどの位置にも配置でき、吸気口 ([モーター筐体カバー]) は、排気ポートに対して4箇所の放射状位置のどの位置にも配置できます。また、[駆動部筐体] も 3箇所の放射状位置のどの位置のエンジン ベル筐体上にも再組付けできます。

備考

方向変更時または再組付け時に [駆動部筐体] を [変速装置] から分離させないでください。

2. エンジンの取り付け要求を検討し、[変速装置] に対する [駆動部筐体] の必要な方向を決定します。[駆動部筐体] の方向を変える必要がある場合、8本の [駆動部筐体キャップ ネジ] (28) を外し、[駆動部筐体] を要求された位置に回転させます。[駆動部筐体キャップ ネジ] を元通りに再組み付けして 28 ft-lb (38 Nm) のトルクで締め付けます。

* Loctite Corporation の登録商標.

備考

方向変更時または再組付け時に [モーター筐体] を [モーター筐体カバー] から分離させないでください。

3. ここで、[駆動部筐体] は、[変速装置] に対して正しい方向にすることができたので、排気ポートが底にあるかないか、および吸気口が、ホースの再組付けに対し、好ましい位置に配置されているかに注意します。これらの構成部品の片方または両方の方向を変える必要がある場合、4個の [モーター筐体カバー ネジ] (4) を外して [モーター筐体]/[モーター筐体カバー] を希望する位置に回転させます。[モーター筐体カバー キャップ ネジ] を元通り再組み付けして 60 ft-lb (81.4 Nm) のトルクで固く締め付けます。

空気始動装置の取り付け

1. 配管図の検討 [始動装置] が表示されたように正しく接続されることを強く推奨します。
2. [始動装置] 再組付け用の空気受けタンクは、[始動装置] が運転される最大圧力以上の動作圧力性能を有する必要があります。

警告

空気圧をバルブまたはコックを通して徐々に減らして無くします。タンク内にまだ圧力が加わっている間にタンクから栓を抜かないでください。

3. 既に使用中の受けタンクに接続しようとする場合、ドレイン バルブを開放して、空気圧を徐々に減らして無くします。タンクの底に溜まった水があれば排出します。

備考

SRV150 始動装置リレーバルブ と [受けタンク] が、バルブ本体に刻印された「IN (入)」という言葉によって示された SRV150 始動装置リレーバルブの吸気口側で接続されていることを確認します。

4. 1-1/2 インチ ショート ニップルを使用して、EN-6上の図面 TPC444-4に示されているように受けタンクの端に　SRV150 始動装置リレーバルブを 再組付けします。
5. ダッシュパネル (車両再組み付け用) または他の適切なパネル (固定再組み付け用) に、No. SMB-618 始動装置制御バルブ　を再組付けします。
6. [始動装置制御バルブ] に隣接する制御パネルに No. TA-STR-100 始動装置指示ラベルを貼り付けます。
7. No. 150BMP-1064 風圧計を制御パネルまたはその周りに取り付けます。風圧計は、[制御バルブ] の運転員が容易に見ることのできる場所に配置してください。

備考

[始動装置制御バルブ] を [リレー バルブ] に接続するときは、ホースが、[始動装置制御バルブ] の ” SUMP” 側に接続されていることを確認します。

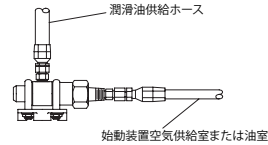
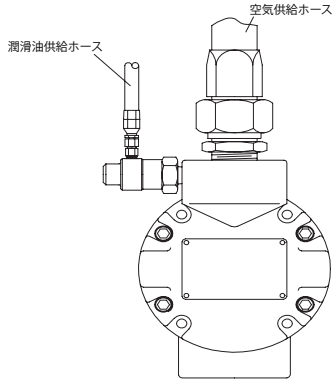
8. [始動装置制御バルブ] と [リレーバルブ] を 1/4 インチ #4 ホースで接続します。このラインに [風圧計] に至る短いフィーダーホースの付いたT字型分岐を取り付けます。
9. 頑丈な庭園用ホースなどの大きな直径のホースを受け器の [リレーバルブ] からエンジンの始動装置の位置まで敷き、必要な 1-1/2 インチ #24 空気ホースの正確な長さを決定します。
10. [リレーバルブ] の排気側に1-1/2 インチ #24 の空気ホースを取り付け、このホースをフレームなどを通って始動装置がある最終位置まで敷きます。
11. この地点で、[始動装置] が実際に取り付けられる前または後に、ホースを [始動装置] に付けることが実際的か、またはそうでないかを決定します。多くのケースで、[始動装置] を取り付ける前に、ホースを [始動装置] に取り付けることが必要である場合があります。
12. リング ギアに良好な粘着性のある、ギア グリースまたはオートバイのチェーン用潤滑油を十分に塗ります。こうすると、リング ギアおよび始動装置のピニオンの寿命を延ばすのに役立ちます。
13. [始動装置] を所定の位置に移動し、フライホイール ベル筐体上に取り付けます。取り付けボルトを100 ft-lb (136 Nm) のトルクまで締め付けます。
14. [始動装置制御バルブ] の ”DEL“ 側から [始動装置駆動筐体] 上の ”IN“ ポートに1/4 インチ #4 ホース ラインを再組付けしす。
15. 1/4 インチ　#4 ホース ラインを [始動装置駆動部筐体] 上の　　” OUT“ ポートから [始動装置リレーバルブ] の上端の小管のタす。
16. 排気が配管で排出されなかった場合、[始動装置] のモーター筐体上の排気ポートに No. SS660-A674 マフラー または No. SM450-A735 道路泥除け装置を再組付けします。
17. [始動装置] が取り付けられているエンジンが標準の始動装置台座の付いたベル筐体が無い場合、および取付け用ブラケットを製作する必要がある場合、[始動装置] のモーターの末端に支持用ブラケットを追加されることを推奨します。[モーター筐体カバ] ーに、この目的用として4箇所の穴があります。これらの穴には、メートル押さえネジが収まるように M10-150 のタップが切られています。
18. EN-3 の図面TPB978 に表示されているように、[始動装置] またはその付近に HDL2 ルブリケータを 取り付けます。
19. 始動システム全体に圧力をかけ、すべての接続部をせっけん泡試験でチェックします。漏れが全く無いことが必要です。

エンジン全体の封じ込み

ときどき、インジェクターの設定およびタイミング調整の両方、またはどちらか一方の目的のために、どのようなピストンも、どのような指定位置にも停止できるような方法でエンジンを封じ込むことが望ましい場合があります。これは、SS815, SS825 および SS850 の各始動装置で非常に簡単に実施できます。

1. [駆動部筐体] 上の **”OUT“** ポートにある1/4 インチ #4 ホースを外し、[駆動部筐体] の穴を1/4 インチ パイプ栓で塞ぎます。
2. [モーター筐体カバー] の中央から 3/8 インチ パイプ栓を外します。
3. フライホイールの付いた [駆動ピニオン] を圧力を加えて [駆動部筐体] 上の **”IN“** ポートにはめ込みます。
4. [モーター筐体カバー] の穴に 3/8 インチのスクエア ドライブ レンチを挿入してローターの後部の凹みにスクエア ドライブをはめ込みます。
5. エンジンが希望の位置にクランクで回転するまで [ローター] を手動で回転させます。

HDL2 ルブリケータは自給式で、[始動装置] 上に直接再組付けするかまたは離して配置することができます。ルブリケータは、再組付け位置から 4 ft (12m) 低い供給源から潤滑油をくみ上げることができますが、**Ingersoll Rand** は、ルブリケータをできるだけ油供給源の近くに再組付けすることを推奨します。潤滑油の供給源として圧力の加わらない燃料戻りラインの使用を推奨します。しかし、油は、別の容器またはジーゼル燃料タンクからも供給できます。ディーゼル燃料タンクが潤滑油供給源であるときは、10 ~ 50 ミクロンの燃料フィルターを燃料タンクの油供給ラインに再組付けします。潤滑油供給ラインが、T字型分岐の脚が下向きでルブリケータに向かい、ルブリケータが油の代わりに空気を取り込むことがないことを保証にラインに流れ込むようにしてください。

HDL2 ルブリケータの再組付け

遠隔 HDL2 ルブリケータの再組付け

(図面. TPB978)

HDL2 ルブリケータを以下のように取り付けます。

1. HDL2 ルブリケータを [始動装置] 上に取り付けようとする場合、[始動装置] の吸入口の突起から 3/8 インチパイプ栓の内の1つを外してHDL2と取り替えます。HDL2 を離れた位置に取り付ける場合、ルブリケータ用に使用できる 2本のU ボルトおよび基礎取付金具を使用します。
2. HDL2 を離れた位置に取り付けた場合、雄ネジ、雌ネジの両方を有するルブリケータの末端から [始動装置] 吸入口の突起上の 3/8 インチ管のタップ付きの穴の内の1つに 1/4" #4 ホースを再組付けします。
3. HDL2 の側面の 1/8" インチ NPTF 注油口から圧力の加わらない燃料ライン、ディーゼル燃料タンクまたは別の油容器に 1/4 インチホースを再組付けします。ルブリケータの取り付け金具を 15 ~ 36 ft-lb (20.3 ~ 40.8 Nm) のトルクで締め付けます。取り付け金具上のネジは清浄にする必要があり、シーリング材または Teflon®* テープを使用せずに取り付け金具を組み立てます。接続は、真空気密にする必要があります。

備考

初期運転の前に、手動で油供給ラインを一杯にします。

4. 別の潤滑油タンクを使用する場合、このタンクを SAE10 または 10W のようなディーゼル燃料または薄いモーター オイルす。

SS815 および SS825 シリーズ始動装置の取り付け寸法

方向オプション		
吸気口	排気管	駆動部筐体
4 @ 90º	4 @ 90º	16 @ 22 1/2º

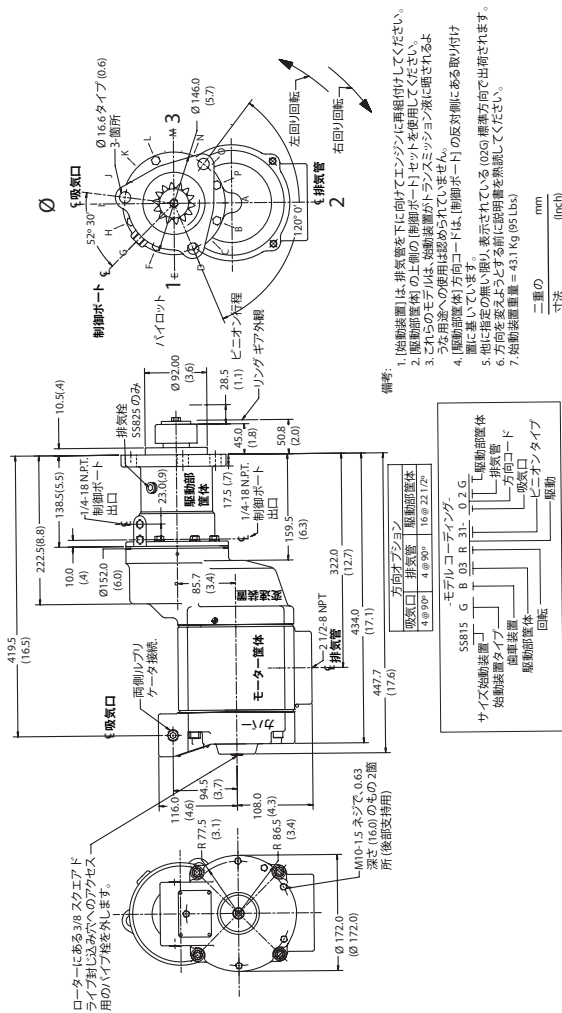
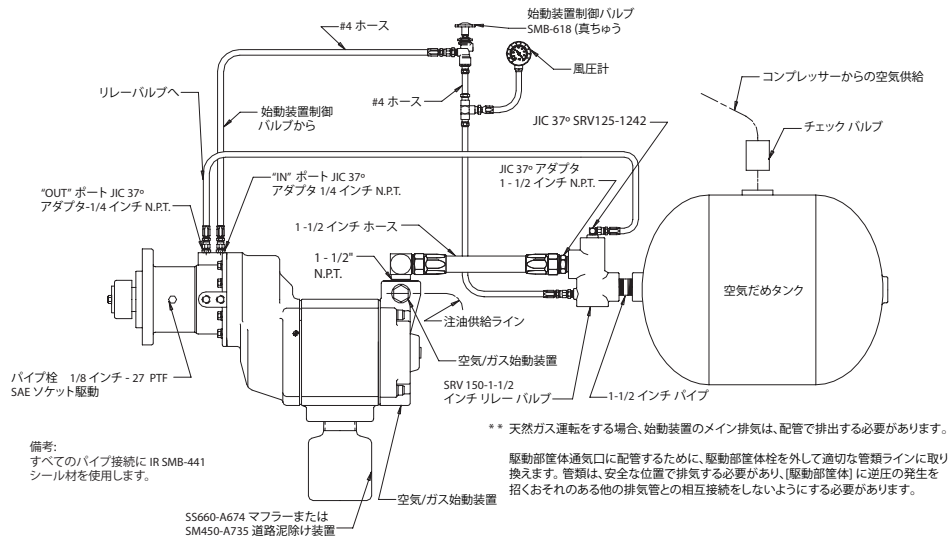
備考:

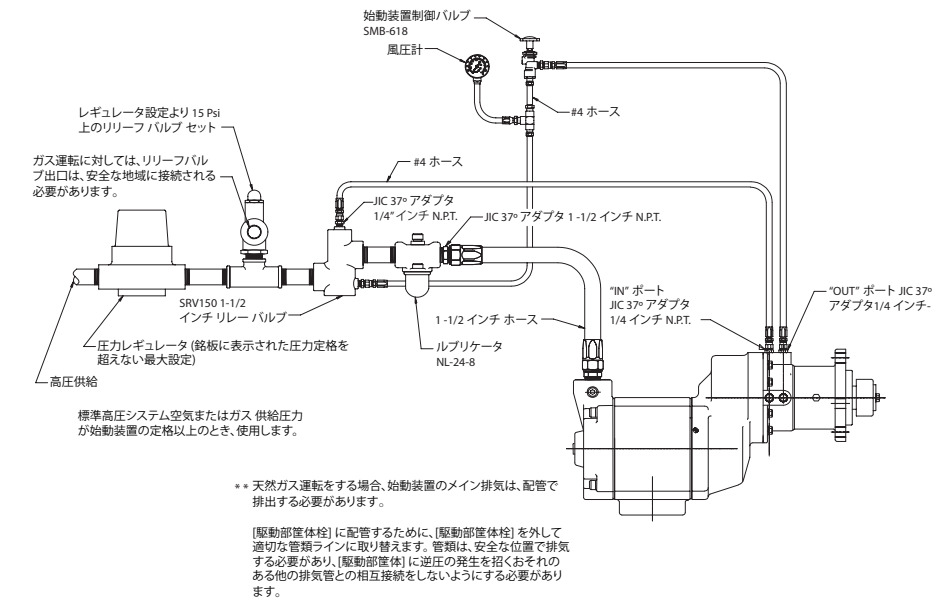
1. [始動装置] は、排気管を下に向けてエンジンに再組付けしてください。
2. [駆動部筐体] の上側の [制御ポート] セットを使用してください。
3. これらのモデルは、始動装置がトランスミッション液に晒されるような用途への使用は認められていません。
4. [駆動部筐体] 方向コードは、[制御ポート] の反対側にある取り付け置に基 いています。
5. 他に指定の無い限り、表示されている (02G) 標準方向で出荷されます。
6. 方向を変えようとする前に説明書を熟読してください。
7. 始動装置重量 = 43.1 Kg (95 Lbs.)

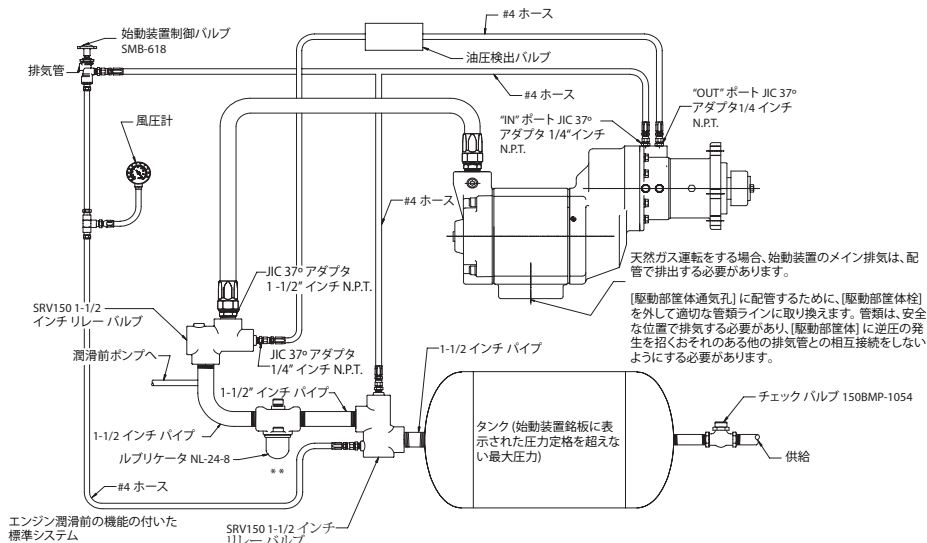
二重の寸法: mm / (Inch)

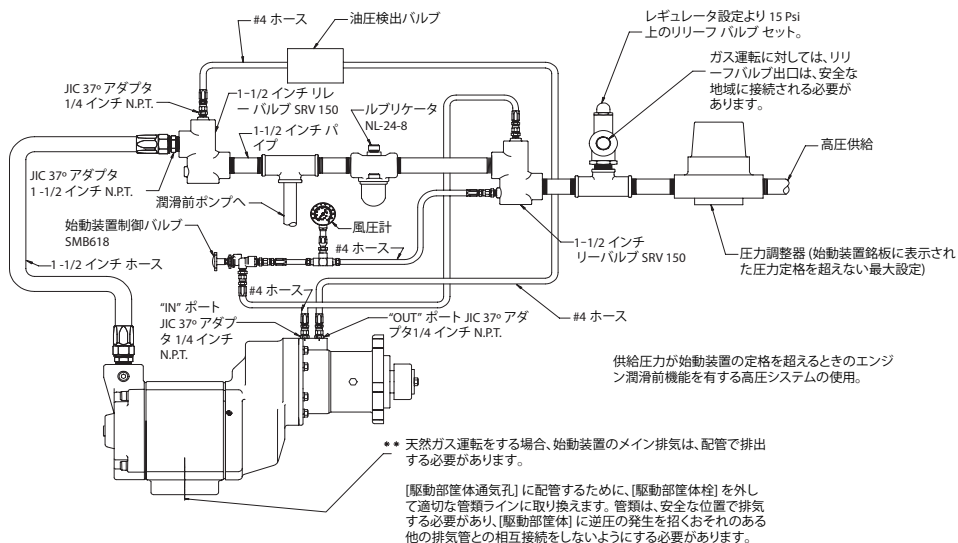
(図面. TPA1325-1)

SS850 シリーズ始動装置の取り付け寸法

(図面. TPA832-5)

典型的な車両再組付け (SS815 始動装置で表示)

(図面. TPC444-4)

典型的な車両再組付け (SS815 始動装置で表示)

(図面. TPA842-2)

エンジン潤滑前システムの典型的再組付け

(図面. TPA843-2)

供給圧力が定格始動装置圧力を超えたときのエンジン潤滑前システムの典型的再組付け

(図面. TPA844-2)

典型的な複式始動装置の再組付け

#4 ホース
#4 ホース
始動装置制御バルブ
SMB-618
JIC 37° アダプタ
1 -1/4 インチ N.P.T.
1-1/2 インチ パイプ
1 -1/2
インチ ホース
"IN" ポート
JIC 37° アダプタ
1/4 インチN.P.T.
"OUT" ポート
JIC 37° アダプタ
1/4 インチ N.P.T.
#4 ホース
JIC 37° アダプタ
1 -1/2 インチ N.P.T.
ルブリケータ NL-24-8
SRV150 1-1/2 インチ リレー バルブ
ガスの場合、排気は配管で排出されるかまたはマフラー SS660-A674 または偏向器 SM450-A375 を使用します。
#4 ホース
1-1/2 インチ パイプ
供給
導管サイズ (図表を参照してください)

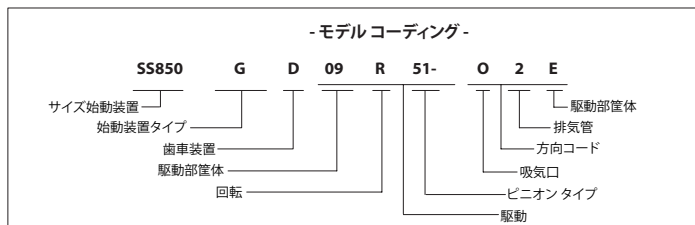
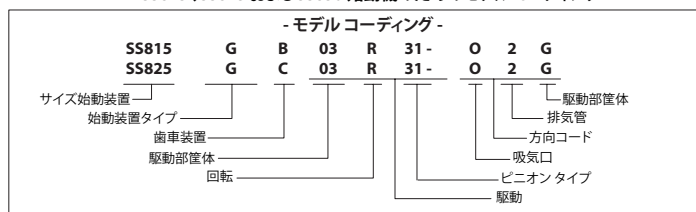
いいえ。始動機の	分. 管のサイズ
2	2"
3	2-1/2"
4	3"
5	3-1/2"

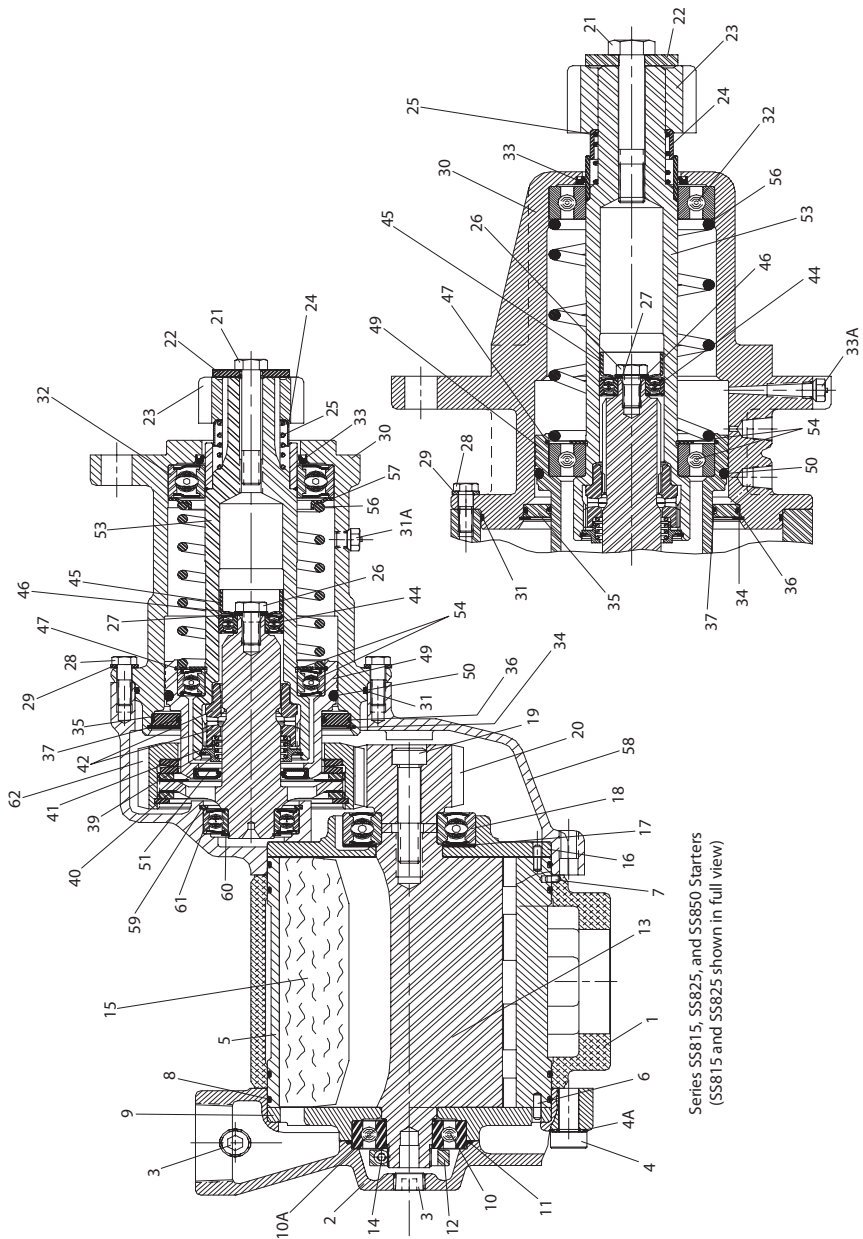
始動機の動くことを用いる始動機で120-150 のPsigを維持するために供給は十分でなければならない。

** 天然ガス運転をする場合、始動装置のメイン排気は、配管で排出する必要があります。[駆動部筐体通気孔] に配管するために、[駆動部筐体栓] を外して適切な管類ラインに取り換えます。管類は、安全な位置で排気する必要があり、[駆動部筐体] に逆圧の発生を招くおそれのある他の排気管との相互接続をしないようにする必要があります。

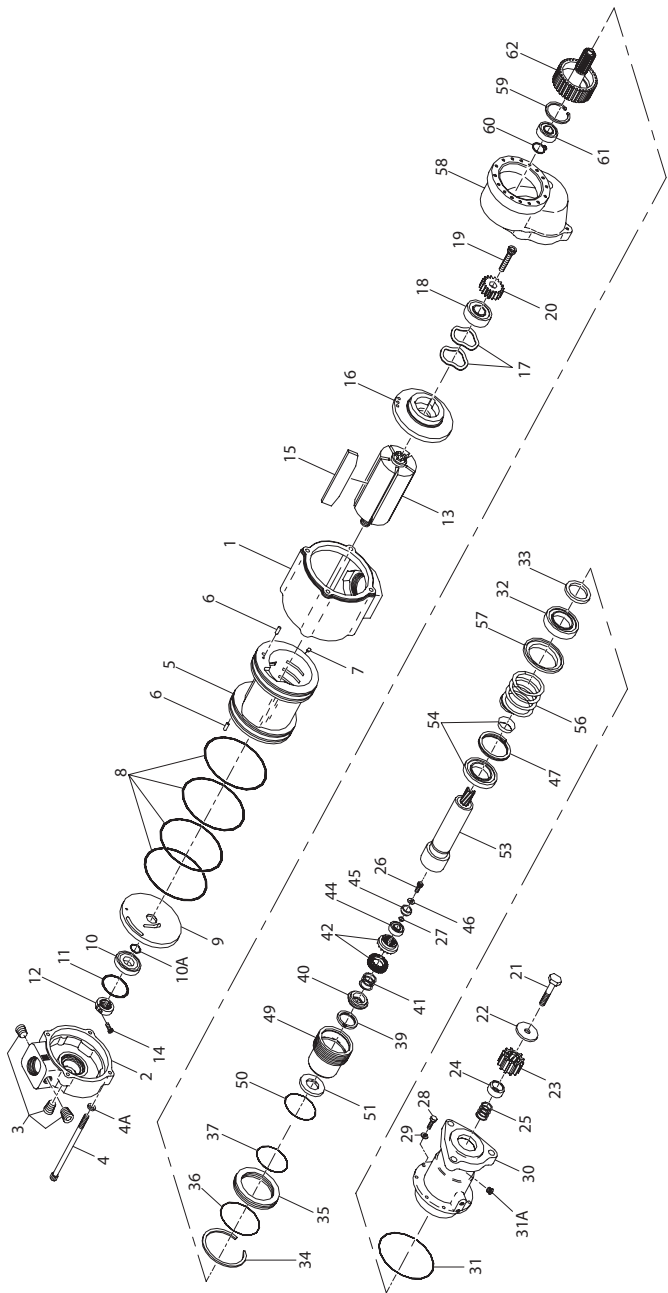
(図面. TPA847-2)

始動装置の発注方法

SS815 、SS825 およびSS850 始動機のためのモデルコーディング

(図面. TPD1495)

Front End Construction of Series SS850

(Dwg. TPA853-4)

Series SS815 and SS825 Starters Exploded Diagram

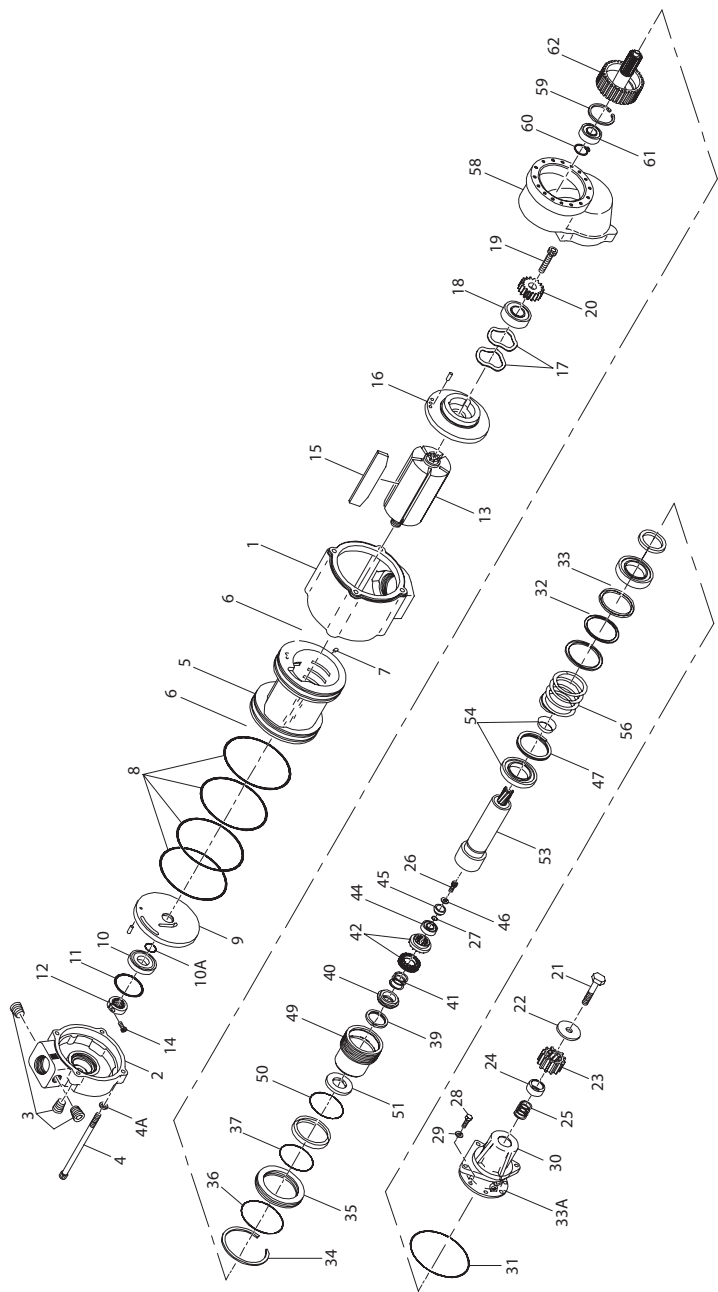
(Dwg. TPA778-6)

Series SS815 and SS825 Starters Parts List

Item	Part Description	Part Number
1	Motor Housing	
	with 2-1/2" Tapped Exhaust	SS800-40
	with 2-1/2" SAEJ518C Flanged Exhaust	SS800-140
2	Motor Housing Cover Assembly	
	with 1-1/2" Tapped Inlet	SS800-A102
	with 1-1/2" SAEJ518C Flanged Inlet	SS800-A202
3	Housing Cover Plug (3)	HSSPPS-3
4	Motor Housing Cover Cap Screw (4)	SS800-25
4A	Motor Housing Cover Cap Screw Washer (4)	SS800-26
5	Cylinder Kit	SS800-K3
† 6	End Plate Alignment Pin (2)	510-669A
† 7	Cylinder Alignment Pin	SS800-99
†• 8	Cylinder O-Ring (4)	SS800-67
9	Rear End Plate	
	for SS815RB or SS825RC Models	SS800R-12
	for SS800LB, SS815LB or SS825LC Models	SS800L-12
† 10	Rear Rotor Bearing	SS800-24
†•10A	Rotor Shaft O-Ring	C321-606
†• 11	Rear Rotor Bearing O-Ring	HRA20A-990
12	Rotor Clamp Nut	SS800-65
13	Rotor	SS825-53
14	Rotor Clamp Nut Screw	SS800-63
†• 15	Vane Packet (set of 5 Vanes)	SS800-42A-5
16	Front End Plate	SS800G-11
17	Motor Wave Washer (2)	SS800-224
† 18	Front Rotor Bearing	SS800-22
19	Rotor Pinion Retaining Screw	SS800-732
20	Rotor Pinion	
	for SS815RB, SS800LB or SS815LB Models	SS800B-17
	for SS825RC or SS825LC Models	SS825C-17
• 21	Drive Pinion Retaining Screw	
	for SS815RB or SS825RC Models	SS800R-394
	for SS815LB or SS825LC Models	SS800L-394
22	Drive Pinion (R) Washer Drive Pinion (L) Washer	SS800-725 SS800-725-1
• 23	Drive Pinion	
	for SS815GB03R31 Models	SS815R-13-31
	for SS815GB03L32 Models	SS815L-13-32
	for SS815GB03R91 and SS825GC03R91 Models	SS815R-13-91
	for SS815GB03L92 and for SS825GC03R25 Models	SS815L-13-92
	for SS825GC03R25 Models	SS825R-13-25
	for SS825GC03L26 Models	SS825L-13-26
24	Pinion Spring Sleeve	SS800-335
† 25	Pinion Spring	
	for SS800RB, SS815RB or SS825RC Models	SS800R-419
	for SS800LB, SS815LB or SS825LC Models	SS800L-419
26	Drive Gear Screw	SS800-179
†• 27	Drive Gear Screw O-Ring	SS800-176
28	Drive Housing Cap Screw (8)	SS800-744
29	Drive Housing Cap Screw Lock Washer (8)	CE210-605
30	Drive Housing Kit	SS825-K300
†• 31	Drive Housing O-Ring	SS800-244
31A	Drive Housing Vent Plug	P250-546
32	Front Drive Shaft Bearing	
	for SS815B Models	SS800-363
	for SS825C Models	SS850-363
† 33	Drive Housing Seal	SS800-271
† 34	Bulkhead Retainer	SS800-181
35	Bulkhead Kit	SS800-K150
†• 36	Outer Bulkhead O-Ring	SS800-152
†• 37	Inner Bulkhead O-Ring	SS800-151
† 39	Clutch Spring Cup Retainer	SS800-366
40	Clutch Spring Cup	SS800-367
† 41	Clutch Spring	SS800-583
42	Clutch Jaw Kit	
	for SS815RB or SS825RC Models	SS800R-K587
	for SS815LB or SS825LC Models	SS800L-K587
44	Front Drive Gear Bearing	SS800-278
45	Drive Gear Cup	SS800-177
46	Drive Gear Lock Washer	SS800-180
47	Large Drive Shaft Bearing Retainer	SS800-107
49	Piston Kit	SS800-K703
†• 50	Piston O-Ring	SS800-337
†• 51	Piston Seal	SS800-273
53	Drive Shaft Kit	
	for SS815RB or SS825RC Models	SS800R-K8
	for SS815LB or SS825LC Models	SS800L-K8
54	Rear Drive Shaft Bearing Kit (includes bearing and retainer)	SS800-K399
56	Piston Return Spring	SS800-700
57	Piston Return Spring Seat	SS800-191
58	Gear Case	SS800-37
59	Drive Gear Bearing Retainer	SS800-361
60	Drive Gear Shaft Bearing Retainer	SS800-632
† 61	Rear Drive Gear Bearing	SS800-359
62	Drive Gear	
	for SS815108 or SS815LB Models	SS815B-9
	for SS825RC or SS825LC Models	SS825C-9
*	Nameplate	SS800-301
*	Nameplate Screw (4)	R4K-302
*	Relay Valve	SRV150
*	Muffler	SS660-A674
*	Road Splash Deflector	SM450-A735
*	Air Strainer	SM450-A267AT
*	Lubricator	HDL2
*	In-Line Lubricator	NL-24-8
*	Tune-up Kit (includes illustrated parts 6[2], 7, 8, 10, 10A[4], 11, 15, 18, 24, 25, 27, 31, 33, 34, 36, 37, 39, 50, 51, 60 and 61)	SS800-TK2

* Not Illustrated

† Indicates Tune-up Kit part.

• To keep downtime to a minimum, it is desirable to have on hand certain repair parts. We recommend that you stock one (pair or set) of each part indicated by a bullet (•) for every four tools in service.

Series SS850 Starters Exploded Diagram

(Dwg. TPA820-3)

Series SS850 Starters Parts List

Item	Part Description	Part Number
1	Motor Housing	
	with 2-1/2" Tapped Exhaust	SS800-40
	with 2-1/2" SAEJ518C Flanged Exhaust	SS800-140
2	Motor Housing Cover Assembly	
	with 1-1/2" Tapped Inlet	SS800-A102
	with 1-1/2" SAEJ518C Flanged Inlet	SS800-A202
3	Housing Cover Plug (3)	HSSPPS-3
4	Motor Housing Cover Cap Screw (4)	SS800-25
4A	Motor Housing Cover Cap Screw Washer (4)	SS800-26
5	Cylinder Kit	SS800-K3
† 6	End Plate Alignment Pin (2)	510-669A
† 7	Cylinder Alignment Pin	SS800-99
†• 8	Cylinder O-Ring (4)	SS800-67
9	Rear End Plate	
	for SS850RD Models	SS800R-12
	for SS850LD Models	SS800L-12
† 10	Rear Rotor Bearing	SS800-24
†• 10A	Rotor Shaft O-Ring	C321-606
†• 11	Rear Rotor Bearing O-Ring	HRA20A-990
12	Rotor Clamp Nut	SS800-65
13	Rotor	SS825-53
14	Rotor Clamp Nut Screw	SS800-63
†• 15	Vane Packet (set of 5 Vanes)	SS800-42A-5
16	Front End Plate	SS800G-11
17	Motor Wave Washer (2)	SS800-224
† 18	Front Rotor Bearing	SS800-22
19	Rotor Pinion Retaining Screw	SS800-732
20	Rotor Pinion	
	for SS850RD or SS850LD Models	SS850D-17
• 21	Drive Pinion Retaining Screw	
	for SS850RD Models	SS850R-394
	for SS850LD Models	SS850L-394
22	Drive Pinion Washer	SS800-725
• 23	Drive Pinion	
	for SS850GD09R51 and SS850FGD09R51 Models	SS850R-13-51
	for SS850GD09L52 and SS850FGD09L51 Models	SS850L-13-52
† 24	Pinion Spring Sleeve	SS800-335
† 25	Pinion Spring	
	for SS850RD Models	SS850R-419
	for SS850LD Models	SS850L-419
26	Drive Gear Screw	SS800-179
†• 27	Drive Gear Screw O-Ring	SS800-176

Item	Part Description	Part Number
28	Drive Housing Cap Screw (8)	SS800-744
29	Drive Housing Cap Screw Lock Washer (8)	CE210-605
30	Drive Housing Kit	SS850-K300
†• 31	Drive Housing O-Ring	SS850-244
32	Front Drive Shaft Bearing	SS850-363
33	Drive Housing Seal	SS850-271
33A	Drive Housing Vent Plug	P250-546
34	Bulkhead Retainer	SS500-181
35	Bulkhead Kit	SS850-K150
†• 36	Outer Bulkhead O-Ring	SS850-152
†• 37	Inner Bulkhead O-Ring	SS805-151
† 39	Clutch Spring Cup Retainer	SS850-366
40	Clutch Spring Cup	SS850-367
† 41	Clutch Spring	SS850-583
42	Clutch Jaw Kit	
	for SS850RD Models	SS800R-K587
	for SS850LD Models	SS800L-K587
44	Front Drive Gear Bearing	SS800-278
45	Drive Gear Cup	SS800-177
46	Drive Gear Lock Washer	SS800-180
47	Large Drive Shaft Bearing Retainer	SS850-107
49	Piston Kit	SS850-K703
†• 50	Piston O-Ring	SS850-337
†• 51	Piston Seal	SS800-273
53	Drive Shaft Kit	
	for SS850RD Models	SS850R-K8
	for SS850LD Models	SS850L-K8
54	Rear Drive Shaft Bearing Kit (includes bearing and retainer)	SS850-K399
56	Piston Return Spring	SS850-700
58	Gear Case	SS850-37
59	Drive Gear Bearing Retainer	SS800-361
60	Drive Gear Shaft Bearing Retainer	SS800-632
† 61	Rear Drive Gear Bearing	SS800-359
62	Drive Gear	SS850D-9
*	Nameplate	SS800-301
*	Nameplate Screw (4)	R4K-302
*	Relay Valve	SRV150
*	Muffler	SS660-A674
*	Road Splash Deflector	SM450-A735
*	Air Strainer	SM450-A267AT
*	In-Line Lubricator	NL-24-8
*	Lubricator	HDL2
*	Tune-up Kit (includes illustrated parts [2], 7, 8, 10, 10A[4], 11, 15, 18, 24, 25, 27, 31, 33, 34, 36, 37, 39, 50, 51, 60 and 61)	SS850-TK2

* Not Illustrated

† Indicates Tune-up Kit part.

• To keep downtime to a minimum, it is desirable to have on hand certain repair parts. We recommend that you stock one (pair or set) of each part indicated by a bullet (•) for every four tools in service.

Maintenance, Disassembly / Assembly Instructions

 WARNING

Always wear eye protection when operating or performing any maintenance on this starter. Always turn off the air supply and disconnect the air supply hose before installing, removing or adjusting any accessory on this starter or before performing any maintenance on this starter.

Lubrication

Each time a Series SS815, SS825 or SS850 Starter is disassembled for maintenance or repair, lubricate the starter as follows:
For temperatures above 32°F (0°C), use a good quality SAE 10 non-detergent motor oil.
For temperatures below 32°F (0°C), use diesel fuel.

1. Lubricate all O-Rings with O-Ring lubricant.
2. Lubricate the Drive Gear (62) with 8 oz. of **Ingersoll Rand** No. 130 Grease.
3. Lubricate the Vanes (15) with 10W non-detergent oil.
4. Lubricate the inside diameter of the Drive Shaft (53) with **Ingersoll Rand** No. 130 Grease.
5. Lubricate the Front Drive Gear Bearing (44) with **Ingersoll Rand** No. 130 Grease.
6. Lubricate the pinion end of the Drive Shaft with **Ingersoll Rand** No. 11 Grease.
7. Wipe a thin film of **Ingersoll Rand** No. 130 Grease in the bore of the Drive Housing (58).
8. Roll the Piston Return Spring (56) in **Ingersoll Rand** No. 130 grease.
9. Coat the outside of the Piston (49) with **Ingersoll Rand** No. 130 Grease.

Disassembly

General Information

1. Do not disassemble the starter any further than necessary to replace worn or damaged parts.
2. When grasping a part in a vise, always use leather-covered or copper-covered vise jaws to protect the surface of the part and help prevent distortion. This is particularly true of threaded members.
3. Do not remove any part which is a press fit in or on a subassembly unless the removal of that part is necessary for replacement or repairs.
4. Always have a complete set of seals and O-Rings on hand before starting any overhaul of a starter. Never reuse old seals or gaskets.
5. Always mark adjacent parts on the Motor Housing Cover (2), Motor Housing (1), Gear Case (58) and Drive Housing (30) so these members can be located in the same relative position when the Starter is reassembled.

Drive Housing

1. Remove the rear Motor Housing Cover Plug (3) from the rear of the Motor Housing Cover (2).
2. Grasp the Drive Pinion (23) in a vise with the Starter supported on the workbench.

NOTICE

Models SS815RB, SS825RC and SS850RD have a left-hand thread; Models SS815LB, SS825LC and SS850LD have a right hand thread.

3. Using a wrench, remove the Drive Pinion Retaining Screw (21).
4. Remove the starter from the vise.
5. Remove the Drive Pinion Washer (22) and the Drive Pinion (23).
6. Slide the Pinion Spring Sleeve (24) and the Pinion Spring (25) off the Drive Shaft.
7. Insert a 3/8" square drive extension through the Motor Housing Cover to hold the Rotor (13) from turning. Using a 5/16" (8 mm) x 8" (203 mm) long hex wrench inserted into the end of the Drive Shaft, unscrew the Drive Gear Screw (26).
8. Unscrew and remove the Drive Housing Cap Screws (28) and Lock Washers (29).
9. Tap the Drive Housing (30) with a plastic hammer to help dislodge it from the Gear Case (58).

Failure to follow this procedure could result in injury to personnel.

10. Place the Drive Housing in an arbor press, piston end up. Apply pressure to the Piston (49) to compress the Piston Return Spring (56) before removing the Bulkhead Retainer (34).
11. Using a screwdriver, remove the Bulkhead Retainer. Ease off the arbor press.

Make sure the tension of the spring pushes the Bulkhead out of the Drive Housing before removing the Drive Housing from the arbor press.

12. Remove the Bulkhead (35) from the Piston.
13. Remove the Outer Bulkhead O-Ring (36) and the Inner Bulkhead O-Ring (37).
14. Slide the Drive Shaft (53) from the Drive Housing.
15. Pull the Piston Return Spring (56) off the Drive Shaft.

NOTICE

Do not remove the Front Drive Shaft Bearing (32) or the Drive Housing Seal (33) unless replacement is necessary and new parts are available. The Bearing and/or the Seal will always be damaged when removed from the Drive Housing.

16. Remove the Piston O-Ring (50) from the Piston.

NOTICE

The following operation will damage the Piston Seal (51). Therefore, always have a replacement Seal on hand.

17. Insert a large screwdriver blade through the Piston Seal so that it rests on top of the Clutch Spring Cup. Pry the Seal out of the Piston.
18. Press the Clutch Spring Cup (40) down and remove the Clutch Spring Cup Retainer (39).
19. Remove the Clutch spring Cup and Clutch Spring (41).
20. Remove the two Clutch Jaws (42).
21. Remove the Front Drive Gear Bearing (44), Drive Gear Cup (45), Drive Gear Lock Washer (46), Drive Gear Screw O-Ring (27) and Drive Gear Screw (26).
22. Using a screwdriver, remove the Large Drive Shaft Bearing Retainer (47).
23. Press the Rear Drive Shaft Bearing and Drive shaft (53) out of the Piston. If the Rear Drive Shaft Bearing needs to be replaced, proceed as follows:
    a. Using a small chisel, cut and remove the small drive shaft bearing retainer on the Drive Shaft.
    b. Press the Rear Drive Shaft Bearing (54) off the Drive Shaft.

Motor Housing

1. Unscrew and remove the Motor Housing Cover Cap Screw (4).
2. Pull the Motor Housing Cover (2) from the motor Housing (1). It may be necessary to dislodge the Motor Housing Cover by tapping it with a plastic hammer.
3. Tap the Gear Case (58) with a plastic hammer to dislodge it from the Motor Housing.
4. Grasp the Rotor Pinion in a vise and using a wrench, remove the Rotor Pinion Retaining Screw (19).
5. Remove the Rotor Pinion (20) from the rotor shaft.
6. Slide the Front End Plate (16), Front Rotor Bearing (18) and Motor Wave Washers (17) off the rotor shaft.
7. Remove the Rotor (13) and Rear End Plate (9) from the Cylinder.
8. Remove and examine each Vane (15). Install a new set of Vanes if any Vane is cracked, spalled or worn to the extent that its width is 15/16" (24 mm) or less at either end.
9. Grasp the Rotor in a vise. Using a 5/32" (4 mm) hex wrench, loosen the Rotor Clamp Nut Screw (14). Unscrew and remove the Rotor Clamp Nut (12).
10. Remove the Large Rear Rotor Bearing O-Ring (11).
11. Remove the Rear End Plate (9) from the rotor shaft.
12. Remove the Small Rear Rotor Bearing O-Ring (10A) from the rotor shaft.
13. If the Rear Rotor Bearing (10) needs to be replaced, remove it from the Rear End Plate.
14. Push the Cylinder (5) out of the Motor Housing.
15. Remove the Cylinder O-Rings (8) from the Cylinder.

Gear Case

1. Place the Gear Case (58) on a workbench.
2. Using retaining ring pliers and working through the access holes in the gear web, remove the Drive Gear Bearing Retainer (59).
3. Pull the Drive Gear (62) out of the Gear Case.
4. Do not disassemble the Drive Gear of Series SS815, SS825 or SS850. If the Drive Gear is defective, install a new or factory rebuilt unit.
5. Using a retaining ring pliers, remove the Drive Gear Shaft Bearing Retainer (60).
6. Remove the Rear Drive Gear Bearing (61) from the Drive Gear.

Assembly

General Instructions

1. Always press on the **inner** ring of a ball-type bearing when installing the bearing on a shaft.
2. Always press on the **outer** ring of a ball-type bearing when pressing the bearing into a bearing recess.
3. Whenever grasping a starter or part in a vise, always use leather-covered or copper-covered vise jaws. Take extra care with threaded parts or housings.
4. Except for bearings, always clean every part and wipe every part with a thin film of oil before installation.
5. Check every bearing for roughness. If an open bearing must be cleaned, wash it thoroughly in a suitable cleaning solution and dry with a clean cloth. **Sealed or shielded bearings should never be cleaned.** Work grease thoroughly into every open bearing before installation.
6. Apply a film of O-Ring lubricant to all O-Rings before final assembly.

Gear Case

1. Place the Drive Gear Bearing Retainer (59) over the rear end of the Drive Gear.
2. Using an arbor press, press the Rear Drive Gear Bearing (61) onto the rear end of the Drive Gear.
3. Using retaining ring pliers, install the Drive Gear Shaft Bearing Retainer (60).
4. Position the Gear Case on a workbench. Using a plastic hammer, seat the Rear Drive Gear Bearing into the Gear Case by tapping the opposite end of the Drive Gear.
5. Using retaining ring pliers and working through the access holes in the gear web, install the Drive Gear Bearing Retainer (59).
6. Lubricate the Drive Gear with approximately 8 oz. (240 mL) of **Ingersoll Rand** No. 130 Grease.

Motor Housing

1. Clamp the Rotor in a vise threaded end up.
2. Install the Rear Rotor Bearing (10) into the Rear End Plate.
3. Using O-Ring lubricant, lubricate and install the Small Rear Rotor Bearing O-Ring (10A) onto the rotor shaft until it butts against the rotor shaft shoulder.
4. Install the Rear End Plate (9), bearing end up, onto the rotor shaft.
5. Screw the Rotor Clamp Nut (12) onto the rotor shaft with the shoulder toward the bearing. Tighten the nut until there is .001" (.02 mm) to .003" (.07 mm) clearance between the Rear End Plate and Rotor.
6. Using a 5/32" (4 mm) hex wrench, tighten the Rotor Clamp Nut Screw (14). After tapping the End Plate away from the rotor face with a plastic hammer, recheck the clearance between the Rear End Plate and Rotor.
7. Check the two End Plate Alignment Pins (6). If they are bent or broken, remove them from the Cylinder and press in a new pin or pins.
8. Check the Cylinder Alignment Pin (7). If it is bent or broken, remove it from the Cylinder and press in a new pin.
9. Using O-Ring lubricant, lubricate and install the two inside Cylinder O-Rings (8).
10. Position the Motor Housing (1) vertically, on two blocks of wood, locating slot up.
11. Using a plastic hammer, tap the Cylinder (5) into the Motor Housing making sure the Cylinder Alignment Pin (7) seats into the slot of the Motor Housing.
12. Using O-Ring lubricant, lubricate and install the two outside Cylinder O-Rings (8).
13. **For Right-Hand Rotation Starter**: Insert the Rotor (13) into the Cylinder, pinion end toward the Cylinder Alignment Pin.

NOTICE

Make sure the protruding End Plate Alignment Pin (6) in the Cylinder aligns with the dowel hole in the Rear End Plate (9) numbered SS800R-12. Make sure the air ports of both the Cylinder and the Rear End Plate align.

For Left-Hand Rotation Starter:
Insert the Rotor (13) into the Cylinder, pinion end away from the Cylinder Alignment Pin.

NOTICE

Make sure the protruding End Plate Alignment Pin (6) in the Cylinder aligns with the dowel hole in the Rear End Plate (9) numbered SS800L-12. Make sure the air ports of both the Cylinder and the Rear End Plate align.

14. Lightly lubricate each Vane (15) and insert one in each of the rotor vane slots.
15. Slide the Front End Plate (16) over the pinion end of the Rotor. The other protruding End Plate Alignment Pin (6) in the face of the Cylinder should align with the dowel hole in the Front End Plate.
16. Insert the two Motor Wave Washers (17) into the Front End Plate well.
17. Install the Front Rotor Bearing (18) into the Front End Plate well.
18. Install the Rotor Pinion (20) on the rotor shaft so that the lugs on the Pinion engage those on the shaft.
19. Screw the Rotor Pinion Retaining Screw (19) into the rotor shaft and tighten to 90 ft-lb (122 Nm) torque.
20. Using O-Ring lubricant, lubricate and install the Rear Rotor Bearing O-Ring (11) onto the Rear Rotor Bearing.
21. Check freeness of the motor by turning the Rotor Pinion. If necessary, tap the Front End Plate with a soft hammer to align the motor.

22. Align the punch marks on the Gear Case (58), Motor Housing (1) and Motor Housing Cover (2) and assemble as follows:
    a. Grasp the Gear Case (58) in a vise by the Drive Gear Shaft.
    b. Insert the pinion end of the motor into the Gear Case.Using a soft hammer, tap the Motor Housing (1) until it seats.
    c. Position the Motor Housing Cover (2) on the Motor Housing. Using a soft hammer, tap the Motor Housing Cover until it is seated on the Motor Housing.

NOTICE

Screw a 12" (305 mm) piece of 1-1/2" (38 mm) pipe into the air inlet to act as a handle to help align the Motor Housing with the Motor Housing Cover and Gear Case.

    d. Lubricate the threads and install the Motor Housing Cover Cap Screws (4) and Lock Washers (4A), alternately tightening each a little at a time to a final torque of 60 ft-lb (81.4 Nm).
24. Install two of the Housing Cover Plugs (3) into the Motor Housing Cover inlet boss and tighten securely.

Drive Housing

1. Press the Rear Drive Short Bearing (54) onto the Drive Shaft.
2. Slide the small bearing retainer, convex side first, onto the Drive Shaft. Press it into position in accordance with the instructions packaged with the new Retainer.
3. Assemble the Drive Gear Screw (26), Drive Gear Lock Washer (46), Drive Gear Cup (45) and Drive Gear Screw O-Ring (27).
4. Grasp the Drive Shaft (53) in a vise, pinion end down. Place assembled Drive Shaft Screw Unit into the Drive Shaft, screw and head down. Lubricate the inside diameter of the Drive Shaft with **Ingersoll Rand** No. 130 Grease.
5. Slide the Front Drive Gear Bearing (44) into the Drive Shaft.
6. Lubricate with **Ingersoll Rand** No. 130 Grease and install the Driving Clutch Jaw teeth facing up and Driven Clutch Jaw teeth facing down into the Drive Shaft.
7. Insert the Clutch Spring (41) into the Drive Shaft.
8. Insert the Clutch Spring Cup (40) into the Drive Shaft.
9. Press the inserted parts into the Drive Shaft, and install the Clutch Spring Cup Retainer (39).
10. Using an arbor press, press the Piston Seal (51), cover side out, into the Piston until it is flush with the piston face.
11. Install the Piston (49) onto the Drive Shaft until the Rear Drive Shaft Bearing seats into the Piston.
12. Using a thin flat blade screwdriver to assist in this operation, coil the Large Drive Shaft Bearing Retainer (47) into the groove of the Piston to retain the outer race of the Drive Shaft Bearing.
13. Lubricate the Piston O-Ring (50) and install it in the groove of the Piston.
14. Position the Drive Housing in an arbor press, pinion end down and install the Drive Housing Seal (33) into the Drive Housing.

NOTICE

Press the Seal into the Drive Housing so that the lip of the Seal faces away from the Drive Pinion.

15. Using a sleeve that contacts the outer race of the Front Drive Shaft Bearing (32), press the Bearing into the Drive Housing until it seats. **For Models SS815 and SS825**, drop the Piston Return Spring Seat (57) on top of the Front Drive Shaft Bearing.
16. Slide the Piston Return Spring (56) onto the Drive Shaft and snap it into the front of the Piston so that it is against the Large Drive Shaft Bearing Retainer (47).
17. Lubricate and insert the assembled Drive Shaft into the Drive Housing.
18. Using O-Ring lubricant, lubricate and install the Outer Bulkhead O-Ring (36) and the Inner Bulkhead O-Ring (37) on the Bulkhead (35).
19. Slide the Bulkhead onto the Piston.
20. With the Drive Housing in the arbor press, press down on the rear face of the Piston.

NOTICE

Feel the underside of the Drive Housing to make sure the Drive Shaft passes through the Bearing.

Using a screwdriver, install the Bulkhead Retainer (34).

Make sure the Bulkhead Retainer is properly seated in the Motor Housing groove before easing off the arbor press.

21. Remove the Drive Housing from the arbor press.
22. Using O-Ring lubricant, lubricate and install the Drive Housing O-Ring (31) in the groove of the Drive Housing.
23. Position the assembled Motor Housing and Gear Case on a workbench. Assembled unit must be upright to accept the Drive Housing.
24. Carefully position the assembled Drive Housing (30) on to the Gear Case so as not to damage the Piston Seal. Align the punch marks of the Gear Case and Drive Housing.
25. Install the Drive Housing Cap Screw Lock Washers (29) and the Drive Housing Cap Screws (28) and tighten to 28 ft-lb (38 Nm) torque.
26. Insert a 3/8" (10 mm) square drive extension bar through the hole in the Motor Housing Cover to prevent the Rotor from turning. Using a 5/16" (8 mm) x 8" (203 mm) long hex wrench inserted into the end of the Drive Shaft, tighten the Drive Gear Screw (26) to 29 ft-lb (39.3 Nm) torque.
27. Using **Ingersoll Rand** No. 11 Grease, Lubricate and slide the Pinion Spring (25) and the Pinion Spring Sleeve (24) over the Pinion end of the Drive Shaft.
28. Lubricate the pinion end of the Drive Shaft with **Ingersoll Rand** No. 11 Grease and install the Drive Pinion (23).
29. Grasp the Drive Pinion in a vise with the Starter supported on a workbench.
30. Place the Drive Pinion Washer (22) onto the Drive Pinion Retaining Screw (21). Install the Drive Pinion Retaining Screw into the end of the Drive Shaft and tighten it to 80 ft-lb (108.5 Nm) torque for SS815 and SS825 Starters, and 125 ft-lb (169.5 Nm) torque for SS850 Starters.

NOTICE

Models SS815RB, SS825RC and SS850RD have a left-hand thread; Models SS815LB, SS825LC and SS850LD have a right-hand thread.

Remove the Starter from the vise.

31. Install the rear Motor Housing Cover Plug (3) and tighten securely.

Test and Inspection Procedure

1. **Clutch Ratcheting**: Turn the Drive Shaft Pinion (23) by hand in the direction of Starter rotation. The clutch should ratchet smoothly with a slight clicking action.
2. **Motor and Gearing Freeness**: Turn the Drive Shaft Pinion (23) opposite the direction of Starter rotation. The Drive Shaft Pinion should turn by hand.
3. **Pinion Engagement:** Apply 50 psig (3.4 bar/345 kPa) pressure to the engagement "In" Port. Drive Shaft Pinion (23) should move outward and air or gas should escape from the "Out" Port. Plug the "Out" Port and apply 150 psig (10.3 bar/l 034 kPa) pressure to the "In" Port. Check and make sure no air or gas is escaping. Measure the dimension from the face of the Drive Shaft Pinion (23) to the face of the mounting flange. It should be 2-23/32" (69.0 + 2.0 mm) for Models SS815, SS825 and 8-3/4" (222 + 2.0 mm) for Model SS850. Remove the pressure from the "In" Port. Measure the distance from the face of the Drive Shaft Pinion (23) to the face of the mounting flange. It should be 1-25/32" 45.0 + 2.0 mm) for Models SS815, SS825 and 7-3/32" (180 + 2.0 mm) for Model SS850.
4. **Motor Vane Action:** Apply 90 psig (6.2 bar/620 kPa) pressure using a 3/8" (9 mm) supply line to the inlet of the motor. Starter should run smoothly.
5. **Motor Seals:** Plug the exhaust and apply 20 psig
6. (1.4 bar/138 kPa) pressure to the inlet of the motor. Immerse the Starter for 30 seconds in a nonflammable solvent. If the Starter is properly sealed, no bubbles, will appear.

Troubleshooting Guide

Trouble	Probable Cause	Solution
Motor will not run	No air supply.	Check for blockage or damage to air supply lines or tank.
	Damaged Motor Assembly	Inspect Motor Assembly and power train and repair or replace if necessary.
	Foreign material in Motor and/or piping	Remove Motor Assembly and/or piping and remove blockage.
	Blocked exhaust system.	Remove Housing Exhaust Cover and check for blockage.
	Defective Control Valve or Relay Valve.	Replace Control Valve or Relay Valve.
Loss of Power	Low air pressure to Starter.	Check air supply.
	Restricted air supply line.	Check for blockage or damage to air lines.
	Relay Valve malfunctioning.	Clean or replace lines or Relay Valve. Lube Relay Valve.
	Exhaust flow restricted.	Check for blocked or damaged piping. Clean or replace piping. Check for dirt or foreign material and clean or remove. Check for ice build-up. Melt ice and reduce moisture build-up to Starter.
	Damaged Motor Assembly.	Replace Motor Assembly.
	Foreign material in Starter Drive.	Foreign material in Starter Drive.
	Damaged or worn Drive parts.	Check Drive components and replace if necessary.
	Inadequate lubrication.	Check the lubricator, inlet hose, fitting, and oil supply hose to make sure they are vacuum tight and free of leaks. Tighten all joints and replace lubricator if necessary.
Starter drive does not engage ring gear or engages and disengages ring gear very slowly.	Clogged control hoses.	Remove the control hoses attached to the Drive Housing and clean them by blowing compressed air through them. **WARNING** **Firmly secure the hose end before turning on the air. Make certain no one is in line with the discharge end of the control hose.**
	Clogged or faulty Control Valve.	Remove and inspect the Control Valve or install a new Control Valve if necessary.
	Broken Clutch Jaws or other parts.	Disassemble Drive Housing and replace broken parts.
Motor runs, pinion engages but does not rotate.	Broken Shaft, Gearing, or Clutch Jaws.	Disassemble Drive Housing and replace broken parts.
Excessive butt engagements.	Dry Drive Pinion Spline.	Remove Drive Pinion and lubricate the Drive Pinion and the helical spline of the Drive Shaft. Refer to **Disassembly of the Drive Housing**.

Parts and Maintenance

The use of other than genuine Ingersoll Rand replacement parts may result in safety hazards, decreased motor performance, and increased maintenance, and may invalidate all warranties.

Ingersoll Rand is not responsible for customer modification of Starters for applications on which Ingersoll Rand was not consulted. Repairs should be made only by authorized trained personnel. Consult your nearest Ingersoll Rand Authorized Service center.

When the life of the Starters has expired, it is recommended that the Starters be disassembled, degreased and parts be separated by material so that they can be recycled.

Manuals can be downloaded from www.irtools.com.

Refer all communications to the nearest **Ingersoll Rand** Office or Distributor.